Fish & Wildlife Division

RESOURCE STATUS AND ASSESSMENT BRANCH

Fish Species at Risk in the Milk and St. Mary Drainages

Alberta Species at Risk Report No. 45

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

103-01778/

Fish Species at Risk in the Milk and St. Mary Drainages

RL&L Environmental Services Ltd.
A member of the Golder Group of Companies

Species at Risk Report No. 45

April 2002

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Publication No. I/062
ISBN: 0-7785-2165-6 (Printed Edition)
ISBN: 0-7785-2166-4 (On-line Edition)
ISSN: 1496-7219 (Printed Edition)
ISSN: 1496-7146 (On-line Edition)

Cover Photo: Lower Milk River at the Pinhorn Ranch, October 2000.

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This publication can be cited as:

RL&L Environmental Services Ltd. 2002. Fish species at risk in the Milk and St. Mary drainages. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 45. Edmonton, AB.

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ACKNOWLEDGEMENTS

RL&L Environmental Services Ltd. would like to thank Terry Clayton, Richard Quinlan, and Sue Cotterill of Alberta Sustainable Resource Development for involving us in this project and for contributing information and guidance during the study. We would also like to thank Ray Ratynski of the Department of Fisheries and Oceans for providing additional funding to conduct a late winter survey in March 2002.

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EXECUTIVE SUMMARY

Alberta Sustainable Resource Development (SRD) initiated studies in 2000 to assess the distribution and relative abundance of species at risk throughout. Within the St. Mary and Milk river drainages, Alberta SRD identified three fish species that were potentially at risk including St. Mary sculpin (*Cottus* sp.), western silvery minnow (*Hybognathus argyritis*), and the stonecat (*Noturus flavus*). Although not listed as a Species at Risk, Alberta SRD was also interested in the status of the brassy minnow (*Hybognathus hankinsoni*) and sauger (*Stizostedion canadense*).

In assessing the status of the three fish species potentially at risk within the Milk and St. Mary river drainages, it was necessary to address two primary questions: 1)Are the populations of the St. Mary sculpin, western silvery minnow, and stonecat increasing, stable or declining? And 2) What habitat variables are key to ensuring the continued viability of St. Mary sculpin, western silvery minnow, and stonecat?

The study area included the mainstem of the Milk, North Milk, and St. Mary rivers, and Lee Creek (a major tributary to the St. Mary River) within Alberta. Flows in the Milk River and St. Mary River systems are influenced by water diversions for irrigation purposes. Irrigation waters are generally diverted into the North Milk River beginning in April, and normally continues until October.

The field programs were conducted during summer and fall 2000 and 2001, generally over a seven to ten day period. Backpack electrofishing and beach seining were the primary fish sampling techniques.

Species Composition

Overall, 16 fish species were encountered in the Milk and St. Mary drainages during the present study. The Milk River had the most diverse range of fish species present, with a total of 14 species. Seven species were recorded in each of the St. Mary River and Lee Creek. Of the five species of interest, all were encountered in the Milk River. Only the St. Mary sculpin was recorded in the St. Mary River and Lee Creek. This was expected since the St. Mary River drainage is located outside the geographical range for the other species of interest.

In both years of study, flathead chub dominated the catch in the Milk River, followed by sucker species, and longnose dace. During 2000 in the St. Mary River, longnose dace dominated the catch followed by St. Mary sculpin. In Lee Creek, longnose dace were numerically dominant in both years, followed by St. Mary sculpin and sucker species. All species of interest, with the exception of St. Mary sculpin were present in low numbers.

Relative Fish Abundance

St. Mary sculpin

The results indicate that the relative abundance of St. Mary sculpin was higher in the North Milk River in 2000-2001 than in 1986. Catch-per-unit-effort (CPUE) values using backpack electrofishing ranged from 3.7 to 10.75 fish/min in 2000-2001, while values in 1986 ranged

from 0.02 to 1.86 fish/min. In the mainstem Milk River, the abundance of St. Mary sculpin increased from downstream to upstream, while in 1986, no trends were apparent. Within the mid-sections of the mainstem Milk River, the maximum CPUE values were 2.51 fish/min in 2000-2001, and in 1986 the maximum values were 2.05 fish/min. During both years, St. Mary sculpin were not present or were in very low abundance in the lowermost sections of the Milk River.

In the St. Mary River and Lee Creek, the relative abundances of St. Mary sculpin during summer were compared with data collected by Paetz (1993). These data were collected at the same locations between the two years of studies. In general, the abundance of St. Mary sculpin varied between years. In 2000, abundances in the St. Mary River at Kimball Fairground were 2.77 fish/min, while values reported by Paetz (1993) was 5.76 fish/min. In Lee Creek at the Cardston water intake, Paetz (1993) reported St. Mary sculpin abundances of 3.60 fish/min, while values in 2000 were 16.6 fish/min.

Stonecat

Relative abundance values of stonecat were much higher in 2000-2001 than in 1986. In 2000-2001, values ranged from 0.1 to 1.8 fish/min, while in 1986 values were 0.09 fish/min at both capture sites. The capture results also indicate that there was a broader distribution of stonecat in 2000-2001 relative to 1986.

Western Silvery Minnow

Western silvery minnow exhibited a limited distribution during both the 2000-2001 and 1986 field sampling programs. This species was encountered near the Pinhorn Ranch in both years and farther upstream at the Deer Creek Bridge in 1986. The overall abundance was low in 2000 and 2001. The overall CPUE during 2000 was 0.03 fish/100 m^2, while that value was 0.9 fish/100 m^2 in 2001. The highest recorded CPUE value at a given site was 1.22 fish/100 m^2 in 2000 and 8.0 fish/100 m^2 in 2001. The highest recorded value in 1986 was 0.57 fish/100 m^2.

Brassy Minnow

Similar to the western silvery minnow, the brassy minnow also displayed a limited distribution during the 2000-2001 and 1986 field sampling programs. In both years, brassy minnows were restricted to the mid-section of the river. At the two lowermost sites within the mid-section, the beach seine CPUE of brassy minnow was higher in 2000-2001 than in 1986. Backpack electrofishing CPUE was similar between 1986 and 2000-2001 (<0.2 fish/min).

Sauger

During the present study, the abundance of sauger was generally low (<1 fish/min). The exceptions were: Site 2 during fall 2000 (CPUE of 3.46 fish/min) and Site 41 during fall 2001 (1.4 fish/min).

Habitat Suitability

St. Mary sculpin

St. Mary sculpin were moderately abundant throughout the St. Mary River and most of the Milk River with the exception of the lowermost sites (low abundance). This indicates that spawning, rearing, and feeding habitat for St. Mary sculpin are not limiting within these

systems. Similarly, overwintering habitat is well represented in both rivers, provided there is adequate stream flows. Surveys conducted in winter 1979/1980 and 1986 confirmed the presence of St. Mary sculpin overwintering throughout the Milk River (Clayton and Ash 1980; RL&L 1986). However, given the very low discharge during December (0.06 m3/s), fish may be subjected to unsuitable habitat conditions during this winter (2001/2002).

Stonecat

Stonecats are generally associated with large substrate during the various life requisite functions (i.e., spawning, rearing, feeding, and overwintering). In the Milk River, stonecat were distributed primarily in the mid to lower reaches. In the lower reaches, coarse substrate was not prevalent but occurred in isolated patches. Stonecats often occupied these isolated patches where available. In the mid reaches of the Milk River, high quality habitats were located between Gold Spring Park and the Weir Bridge (i.e., presence of extensive areas of boulder-garden habitat types). A potential rearing site based on the high abundance of juvenile stonecat captured was located at Site 25. Overwintering habitat for stonecats is likely limited in the Milk River during most years due to the very low winter flows. In November 1979, numerous stonecats (n=29) were captured from a pool in the vicinity of the Deer Creek Bridge, indicating probable overwintering use in that area (Clayton and Ash 1980). During the present study, no pools were observed in this particular vicinity, indicating low overwintering suitability.

Western Silvery Minnow

Rearing habitat for western silvery minnow consists of quiet waters in rivers with slow to moderate velocity (Willock 1969; Scott and Crossman 1973). This type of habitat, as well as suitable feeding areas for the western silvery minnow appeared to be abundant in the lower reaches of the Milk River during the study. However, this was not the case in fall 2001. Due to the extreme drought conditions and early closure of diversion headgates, only isolated pools were present in the lower Milk River near the Pinhorn Ranch during the fall sampling program. Fish in this area were stranded in shallow isolated pools.

Overwintering habitat has been documented in the lower reaches of the Milk River. Clayton and Ash (1980) documented two silvery minnows in the vicinity of the Deer Creek Bridge. Although overwintering areas have previously been documented, low or no winter flows may reduce overwintering potential in some years (e.g., winter 2000/2001 and 2001/2002). Although suitable rearing, feeding, and overwintering habitat appear to be widely available in the lower Milk River, few western silvery minnow have been documented. Other factors are evidently influencing their distribution and abundance in this river system.

Overall Limiting Habitat Characteristics in the Milk River

Of major concern at present is the limited availability of water for fish overwintering during the winter of 2001/2002. During fall 2001, there was no flowing water in the lower sections of the Milk River (Km 40 to 60 and downstream); only small isolated pools with shallow water depths were present. Thus fish will not be able to emigrate if unsuitable living conditions persist (i.e., pools freezing to the bottom and very low dissolved oxygen levels causing anoxic conditions). In the mid section of the river (Km 200 at the Town of Milk River), the river was flowing in December. However, these flows were approaching zero (0.06 m3/s) and were the second lowest recorded in 93 years. It is likely that large numbers of fish (all species) will not

survive the winter of 2001/2002 (particularly in the mid to lower sections of the river). The current conditions during the winter 2001/2002 could be devastating to fish populations that are presently considered rare or "at risk". If, in the worst case, these populations are extirpated, it is likely that western silvery minnow, stonecat and sauger could recolonize from downstream sections near the Fresno Reservoir; the St. Mary sculpin could recolonize from the St. Mary River (through the diversion canal). However, brassy minnow have not been previously recorded from downstream sections near the Fresno Reservoir. As such, there is a concern that brassy minnow may not re-establish in its former range. Although there is a source for recolonization for most species, it could take many years to develop self-sustaining, viable populations.

Are the populations of the Species at Risk increasing, stable or declining?

St. Mary Sculpin: The abundance of St. Mary sculpin has increased in the North Milk River and the mainstem, while their abundance has remained stable in the lower Milk River.

Western Silvery Minnow: The population of western silvery minnow is stable, but that this species is rare in the Milk River.

Stonecat: The population of stonecat in the Milk River is stable, but is characterized by low abundance.

What habitat variables are key to ensure the continued viability of the Species at Risk?

St. Mary Sculpin
Results indicate that St. Mary sculpin generally occupy riffle and shallow run habitats, characterized by low to moderate velocities, and gravel and cobble substrate. These types of habitat variables were most prevalent in the mid to upper sections of the Milk and North Milk rivers, and throughout the St. Mary River drainage.

Western Silvery Minnow
Western silvery minnow was documented only in the lower Milk River. This species was associated with sandy, shallow flat and run habitat types, characterized by low to moderate velocities. Silvery minnows were also found residing at the mouth of coulees, where there was refuge from the river current, and depth and turbidity provided cover.

Stonecat
The results during the present study indicate that stonecat are generally associated with large rock substrates located in shallow flats, runs and riffle/boulder gardens; associated velocities were typically low to moderate. Although these types of habitat variables were present in the mid to upper sections of the Milk River, stonecat were primarily encountered in the mid to lower sections of the Milk River.

Recommendations for future studies include:

- Since there is much uncertainity as to the genetic status of the St. Mary sculpin (*Cottus* sp.), priority should be taken to analyze DNA samples collected in October 2001 (n=50 from each of the Milk River and St. Mary);

- Due to the extreme drought conditions observed in October 2001, a late winter/early spring study should be conducted to determine the extent of winter-kill in the isolated pools in the lower Milk River;

- To continue to assess the status of the species of interest, future monitoring studies should be completed on a scheduled basis (i.e., every 3 years) using standardized methods (e.g., backpack electrofishing); sampling should occur during similar times of the year (e.g., fall) and be conducted in representative (index) sites;

- Of the five species of interest, more detailed studies on the distribution, abundance, and habitat preferences of the western silvery and brassy minnows are required (i.e., due to their limited distribution).

1.0 INTRODUCTION

1.1 Background

Alberta Sustainable Resource Development (formerly Alberta Environment), Fish and Wildlife Division initiated studies in 2000 to assess the distribution and relative abundance of species at risk throughout Alberta in accordance with the National Accord for the Protection of Species at Risk. Within the St. Mary and Milk river drainages, Alberta SRD identified three fish species that were potentially at risk including St. Mary sculpin (*Cottus* sp.), western silvery minnow (*Hybognathus argyritis*), and the stonecat (*Noturus flavus*). Although not listed as a Species at Risk, Alberta Fish and Wildlife Division was also interested in the status of the brassy minnow (*Hybognathus hankinsoni*) and sauger (*Stizostedion canadense*). Hereafter, all five aforementioned species will be referred to as "species of interest". This report is a compilation of data collected during two years of study (2000 and 2001).

1.2 Purpose and Study Objectives

In assessing the status of the three fish species potentially at risk within the Milk and St. Mary river drainages, it was necessary to address two primary questions:

- Are the populations of the St. Mary sculpin, western silvery minnow, and stonecat increasing, stable or declining?
- What habitat variables are key to ensuring the continued viability of St. Mary sculpin, western silvery minnow, and stonecat?

The specific objectives of the present study were:

- Define and document the seasonal distribution and relative abundance of the species of interest;
- Compare seasonal relative abundance of fish species during the present study with historical data;
- Identify potential critical habitats for the St. Mary sculpin, western silvery minnow, and stonecat;
- Collect information on fish species composition by river reach;
- Characterize the habitats utilized for the species of interest; and
- Measure physical and chemical parameters at sampling sites.

1.3 Study Area

The study area included the mainstem of the Milk, North Milk, and St. Mary rivers, and Lee Creek (a major tributary to the St. Mary River) within Alberta. The length of river investigated was extensive, including the Milk River (170 km), the North Milk River (90 km), and the St. Mary River (40 km section upstream of the reservoir; Figure 1.1).

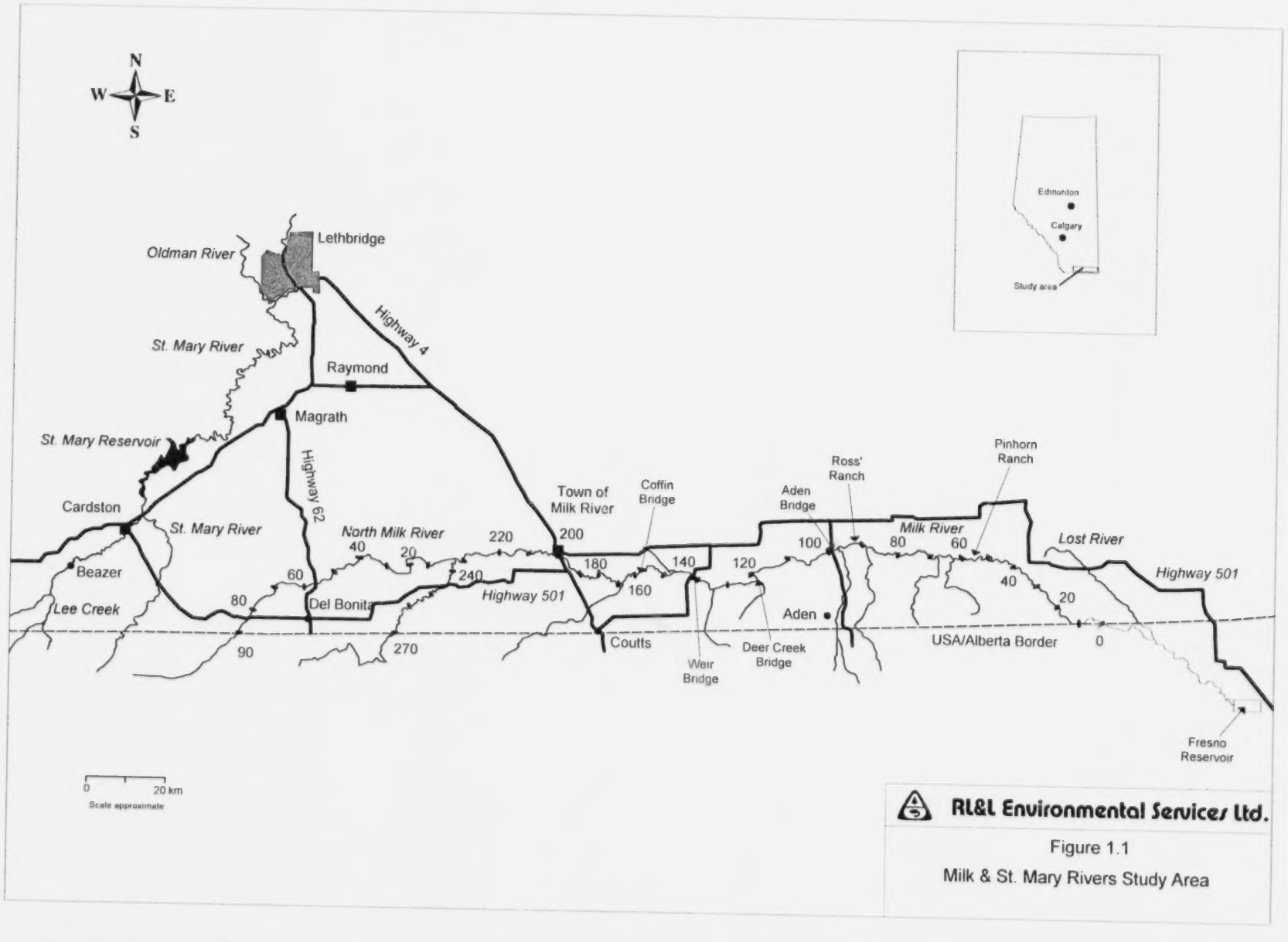

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Figure 1.1

Milk & St. Mary Rivers Study Area

Flows in the Milk River and St. Mary River systems are influenced by water diversions for irrigation purposes. In 1917, the St. Mary Canal was built to divert irrigation waters from the St. Mary River to the North Milk River. The canal runs from the St. Mary River near Babb, Montana to approximately 8 km south of the international border where water is transferred to the North Milk River. Irrigation waters are generally diverted into the North Milk River beginning in April, and normally continue until October. However, in 2001 the headgates to the diversion canal closed in August for construction upgrades.

Peak monthly flows generally occur during May to July as a result of the diverted flow. Mean monthly flows at the town of Milk River for the period 1909 to 2000 ranged between 9.3 and 19.2 m^3/s for the months of April to September, and were <3 m^3/s between October and December (data obtained by Water Survey Canada, January 2001).

2.0 METHODS

2.1 Field Sampling

Sampling during the 2000 and 2001 field programs were conducted by a two-person crew. The summer program in 2000 occurred between 7 and 16 August, whereas the 2001 sampling occurred from 18 to 20 July. The sampling dates for the fall field programs were similar for both years (17 to 24 October). During summer and fall 2000, access to sites was by 4-wheel drive truck. In 2001, access to sites during the summer visit was by 4-wheel drive truck and an inflatable boat fitted with a 15 Hp outboard motor, while during fall, access was by 4-wheel drive truck and ATV.

In 2000, 20 sites were assessed during both the summer and fall sampling sessions (Figures 2.1 to 2.3; Appendix A - Site Data). The summer program included 10 sites on the Milk River, six on the St. Mary River, and four on Lee Creek. During fall, the majority (n=18) of the 20 sites were located on the Milk River. The decision to reduce sampling effort to two sites in the St. Mary Drainage was based on the confirmation of a wide distribution of St. Mary sculpin in this drainage (this species was previously recorded at all sample sites during summer, except the two most upper sites in Lee Creek), and the fact that the other species of interest have not been documented in this system.

During summer 2001, 10 sites were sampled in the lower Milk River; these sites were located within the Pinhorn Ranch grazing lease (Figures 2.1, Appendix A - Site Data). During fall, 23 sites were sampled; these included 20 sites on the Milk River and three sites on the St. Mary drainage system. Sampling effort was focussed on the lower Milk River to capture western silvery minnows. Representative index sites for all other species of interest were chosen based on capture data from 2000.

2.1.1 Fish

During the summer 2000 survey, three fish capture techniques were utilized: boat electrofishing, backpack electrofishing and beach seining. Typically, a minimum of two methods were employed at each site to ensure that all species and life stages were captured. Sampling methods chosen at a given site were determined by sampling conditions (i.e., substrate type, velocities, and water depth).

Boat electrofishing was used during the initial stages of the summer 2000 session (n=4) to determine the effectiveness of this method for capturing species of interest. When it became apparent that this method was ineffective in comparison to the two other methods, it was discontinued. Boat electrofishing is generally more effective at capturing larger-sized fish (>250 mm), which were not a priority in the present study (with the exception of sauger).

The boat electrofisher was operated from an inflatable double-bowed drift boat fitted with a rowing frame. The electrofishing apparatus consisted of a Smith-Root Type VIA unit powered by a 4000 W Generac generator. Two anodes positioned on fixed booms extended from the bow; each anode consisted of six-dropper cables (surface area = 188 cm^2). The boat

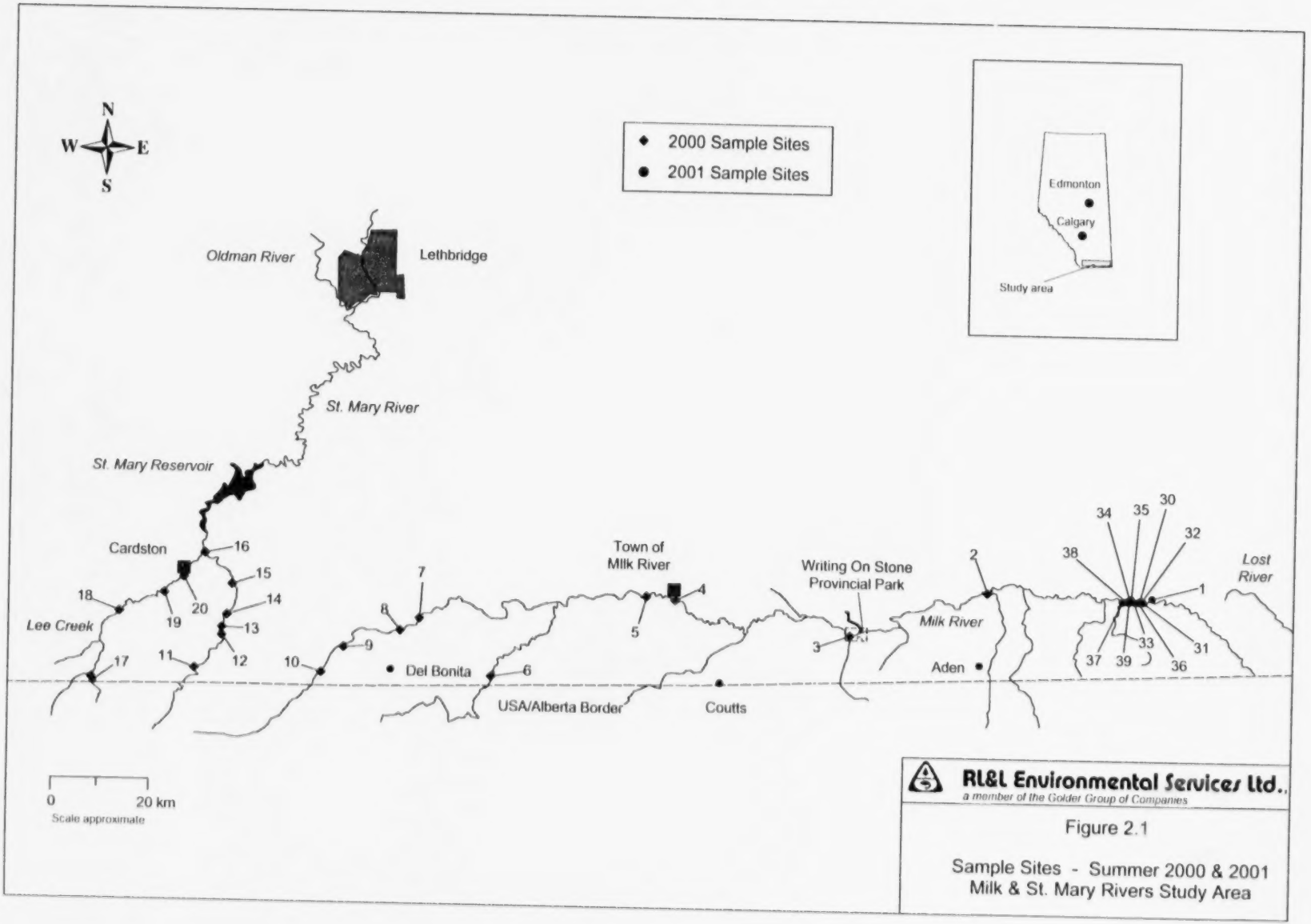

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Figure 2.1

Sample Sites - Summer 2000 & 2001
Milk & St. Mary Rivers Study Area

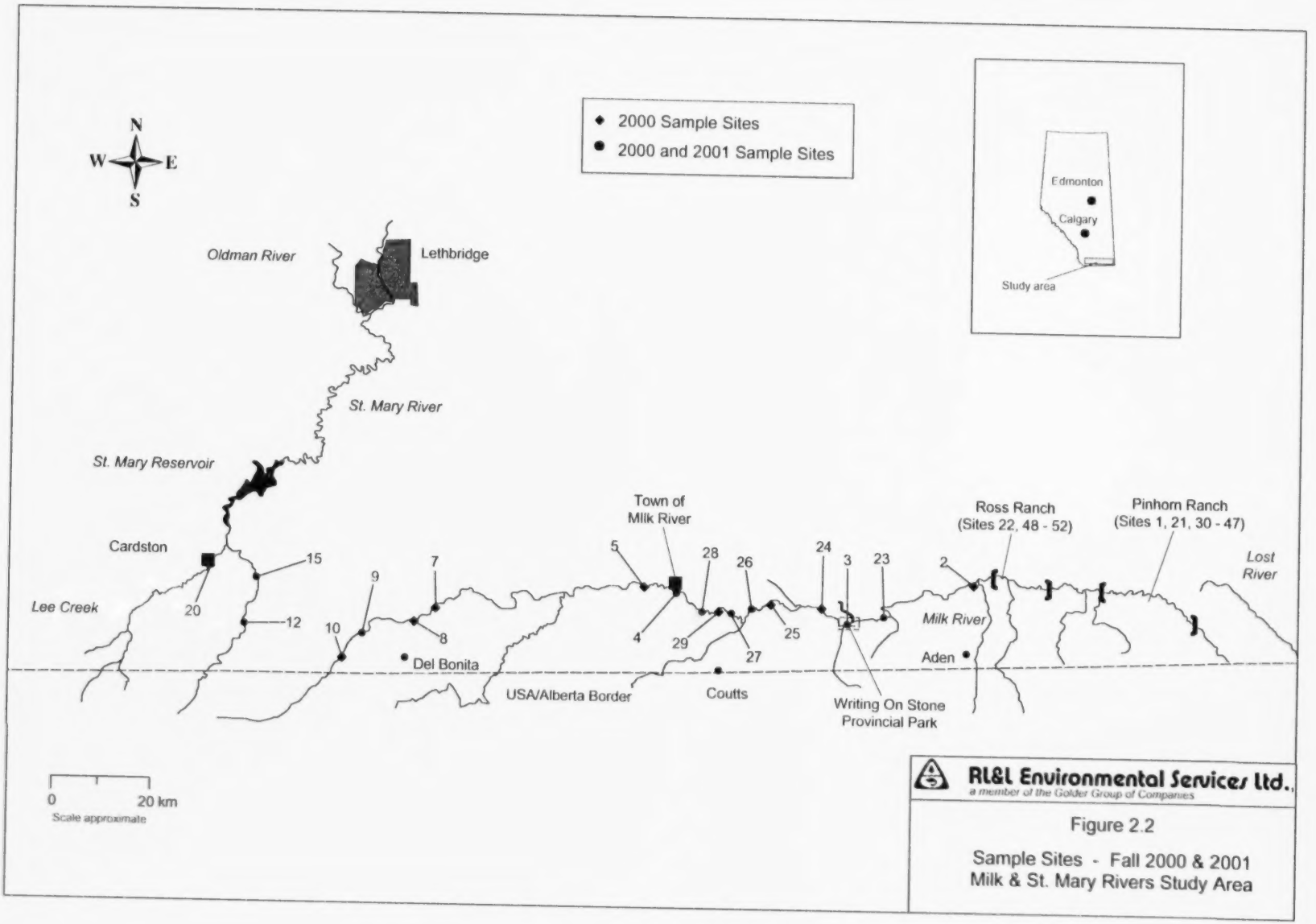
2000 Sample Sites
2000 and 2001 Sample Sites
N
W
E
S
Edmonton
Calgary
Study area
Oldman River
Lethbridge
St. Mary River
St. Mary Reservoir
Cardston
Lee Creek
Town of
Milk River
Ross Ranch
(Sites 22, 48 - 52)
Pinhorn Ranch
(Sites 1, 21, 30 - 47)
Lost
River
Milk River
Aden
Del Bonita
USA/Alberta Border
Coutts
Writing On Stone
Provincial Park
20
15
12
9
7
10
8
5
4
28
29
26
27
24
25
3
23
2
0
20 km
Scale approximate
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Figure 2.2
Sample Sites - Fall 2000 & 2001
Milk & St. Mary Rivers Study Area

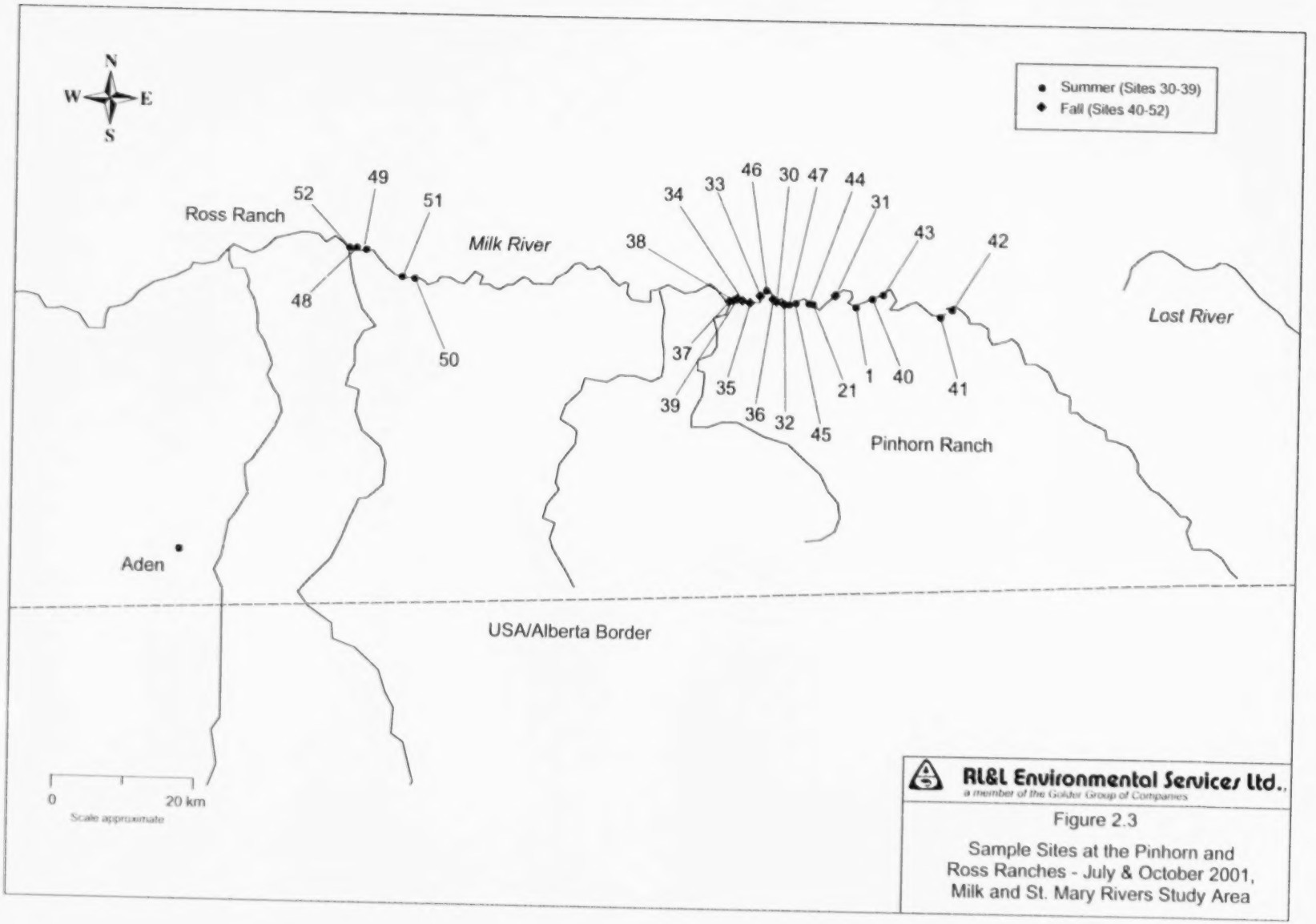

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Figure 2.3

Sample Sites at the Pinhorn and Ross Ranches - July & October 2001, Milk and St. Mary Rivers Study Area

was equipped with a cathode comprised of 18 dropper cables (surface area = 565 cm^2) situated at the bow. Amperage output ranged from 3.0 to 6.0 A at a pulse frequency of 60 Hz using direct current.

Sampling consisted of electrofishing while drifting in a downstream direction. One individual of the two-person crew was situated at the bow of the boat and netted immobilized fish, while the other person navigated. Captured fish were immediately placed in a 30 L live-well. At the end of each electrofishing section the observed and captured fish were enumerated and measured (fork length). All captured fish were released into suitable holding water.
Beach seining was used in both years of sampling (2000 & 2001) to sample habitats characterized by low to moderate water velocities (<0.7 m/s) and shallow water depths (<0.8 m). Where possible (i.e., sufficient area with suitable substrate, depth and velocity), three hauls (each 25 m in length) were completed at each site. A 6.0 m long beach seine with a mesh size of 5 mm was used (also equipped with a collection bag). Information recorded at seine haul sites included location (UTM coordinates), depth (m), velocity (m/s), substrate composition, haul length (m), width (m), and sampling efficiency. Stream velocity was measured at three points (inshore, mid, and offshore) along the haul using a Swoffer Model 2100 digital flow meter. All captured fish species were enumerated. Fork length was measured for specimens of the species of interest. For the remaining fish species, some of which were present in large numbers, only a subsample were measured (minimum of 10/species per site).

A Smith-Root Type XII high output backpack electrofisher was utilized in both years of sampling (2000 & 2001) to sample fish in areas, which were not suitable for seining. The electrofisher operator waded in the channel in an upstream direction, and sampled in the vicinity of suspected fish holding areas (undercut banks, boulder cover, etc.). The netter, who was positioned immediately downstream, collected the fish and placed them in a holding bucket. Pertinent data recorded at each sample site included UTM coordinates, date and time of day, water temperature, distance sampled (m), sampling effort (s), habitat conditions (depth, substrate, cover type, etc.), electrofisher settings, as well as the number and species of fish captured or observed.

2.1.2 Habitat

Aquatic habitats were characterized at each sample site according to the method of O'Neil and Hildebrand 1986 (Appendix B). This method has been used extensively throughout streams and rivers in southern Alberta, including previous studies on the Milk River. The procedure differentiates stream habitat into discrete habitat units according to type (e.g., run, riffle, pool) and quality (takes into account depth and cover). This system provides an efficient method for describing and rating physical habitat capability. Detailed mesohabitat characteristics were recorded at each site (e.g., habitat type and channel and wetted widths). Microhabitat characteristics were recorded where species of interest were captured; these included water depth and velocity at capture location, substrate composition, substrate size, availability of instream cover types, silt depth, and D90. Substrate composition and instream cover types were visually assessed as a percentage of the area within a 1 m radius of the capture location of species of interest. Substrate size was determined by recording 10 random measurements on substrate within a 1 m radius of the capture location. D90 represented the intermediate diameter of the bed material particle size that was greater than 90% of all

substrate present in the channel. Photographs of representative habitats were taken at each site (Appendix C).

Water conductivity and pH were measured with an Oakton TDSTestr3 (±1.0 µS/cm) and an Oakton pHTestr2 (±1.0), respectively. Turbidity samples were collected from each site, preserved and measured in the laboratory with an Orbeco-Hellige Model 966 meter (0.01 NTU). Dissolved oxygen concentrations (±0.01 mg/L) and temperature (±0.1°C) were measured at each site using an Oxyguard Handy Beta dissolved oxygen-temperature meter. In 2000, water temperature was continuously monitored (30 min intervals) at three locations within the study area and at one location during 2001. Monitoring was carried out during part of the open water season (early August to late October) using Vemco Minilog-TR thermographs. Discharge data for the Milk and St. Mary rivers were obtained from Water Survey Canada (Stations 11AA0005 and 05AE027, respectively).

2.2 Data Analysis

Relative abundance of fish was calculated in terms of catch-per-unit-effort (CPUE) based on the number of captured fish per unit of effort, which was dependent on the sampling method. For backpack electrofishing, CPUE was expressed as number of fish captured per minute. Observed fish were included in the backpack electrofishing catch totals to more accurately reflect species abundance and composition. Beach seining catch rates were calculated as the number of fish/100 m^2 for each species.

A One-way Analysis of Variance (ANOVA) was used to determine statistical differences in the mean size of the species of interest between sites. Where results were significant, a post hoc range test (Dunnett's C for unequal variance) was performed to determine which sites contributed to the significant differences in mean fork length. Statistical significance was accepted at $P<0.05$.

A One-way Analysis of Variance (ANOVA) was also used to determine statistical differences in the means of habitat variables between sites. This was performed to determine if each of the species of interest consistently utilized similar ranges in habitat variables (i.e., not significant results) throughout the river systems or to determine if they utilized a range in habitat variables (i.e., significant results). Statistical significance was accepted at $P<0.05$.

3.0 RESULTS

3.1 Fish

3.1.1 Species Composition

2000

In total, 4911 fish were encountered in the Milk and St. Mary drainages. The catch represented 16 fish species (Table 3.1; Appendix D). Of these, 3234 fish were encountered in the Milk River (representing 14 species), 526 fish in the St. Mary River (7 species), and 1151 fish in Lee Creek (7 species). Of the five study species, all were encountered in the Milk River. In the other two systems, St. Mary sculpin was the only fish species of interest encountered. This was expected since the St. Mary River drainage is located outside the geographical range for the other species of interest.

Overall, flathead chub dominated the catch in the Milk River (33%), followed by sucker species (29% combined), and longnose dace (26%). In the St. Mary River, longnose dace comprised 61% of the catch, followed by St. Mary sculpin (28%). In Lee Creek, longnose dace were numerically dominant (82%), followed by sucker species (15%), and St. Mary sculpin (3%).

Species composition varied seasonally in both the Milk and St. Mary rivers. In the Milk River during summer, longnose dace dominated the sample (48%), followed by sucker species (42%; Table 3.2). However, during fall, flathead chub made the largest contribution (44%), followed by sucker species (24%), longnose dace (17%), and St. Mary sculpin (12%).

In the St. Mary River during summer, the catch was comprised primarily of longnose dace (71%), followed by St. Mary sculpin (21%). In contrast, during fall, St. Mary sculpin contributed the most to the catch (52%), followed by longnose dace (26%). Lee Creek was sampled only during summer, where longnose dace dominated the sample at this time (82%).

St. Mary sculpin comprised a greater proportion of the catch during the fall than during summer in both the Milk and St. Mary rivers. In the Milk River, the percentage contribution increased from 4% during summer to 12% during fall. Similarly, in the St. Mary River, the contribution of St. Mary sculpin increased from 21% to 52%.

Brassy minnow and sauger made similar contributions to the catch during both summer and fall, while stonecat and western silvery minnow were present only during the fall sampling. These species of interest represented low numbers of the catch during all seasons sampled (<1.6%).

Table 3.1 Overall percent composition of fish species encountered in the Milk and St. Mary drainages, 2000.

Species	Milk River		St. Mary River		Lee Creek	
	No.	Percent	No.	Percent	No.	Percent
Brassy minnow	9	0.3				
Sauger	19	0.6				
St. Mary sculpin	314	9.7	146	27.8	33	2.9
Stonecat	34	1.1				
Western silvery minnow	2	0.1				
Burbot	4	0.1				
Cutthroat trout					3	0.3
Flathead chub	1064	32.9				
Lake chub	22	0.7			1	0.1
Longnose dace	836	25.9	323	61.4	941	81.8
Mountain whitefish	1	<0.1	21	4.0		
Rainbow trout					2	0.2
Trout-perch	1	<0.1	8	1.5		
Unidentified	1	<0.1	1	0.2	1	0.1
Longnose sucker	89	2.8	7	1.3		
Mountain sucker	34	1.1	3	0.6	93	8.1
Sucker spp.	793	24.5	15	2.9	76	6.6
White sucker	11	0.3	2	0.4	1	0.1
Total	**3234**	**100.0**	**526**	**100.0**	**1151**	**100**

2001

In total, 8008 fish were encountered in the Milk and St. Mary drainages; this represented 16 species (Table 3.3; Appendix D). Of these fish, 7817 were encountered in the Milk River (representing 13 species), 115 in the St. Mary River (5 species), and 76 in Lee Creek (6 species). Similar to 2000, all five species of interest were encountered in the Milk River, while St. Mary sculpin was the only species of interest encountered in the St. Mary River and Lee Creek.

Overall, flathead chub dominated the catch in the Milk River (62%), followed by sucker species (27% combined), and longnose dace (8%). In the St. Mary River, St. Mary sculpin comprised 74% of the catch, followed by sucker species (12%) and longnose dace (11%). In Lee Creek, longnose dace were numerically dominant (50%), followed by St. Mary sculpin (22%), and sucker species (21%).

Table 3.2 Seasonal percent composition of fish species encountered in the Milk and St. Mary drainages, 2000.

Species	Milk River				St. Mary River				Lee Creek	
	Summer		Fall		Summer		Fall		Summer	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Brassy minnow	1	0.1	8	0.3	-		-		-	
Sauger	1	0.1	18	0.8	-		-		-	
St. Mary sculpin	38	4.2	276	11.8	89	21.4	57	51.8	33	2.9
Stonecat			34	1.5	-		-		-	
Western silvery minnow			2	0.1	-		-		-	
Burbot	1	0.1	3	0.1						
Cutthroat trout									3	0.3
Flathead chub	45	5.0	1019	43.7						
Lake chub	4	0.4	18	0.8					1	0.1
Longnose dace	437	48.4	399	17.1	294	70.7	29	26.4	941	81.8
Mountain whitefish			1	0	21	5.0				
Rainbow trout									2	0.2
Trout-perch			1	0	3	0.7	5	4.5		
Unidentified			1	0	1	0.2			1	0.1
Longnose sucker	26	2.9	63	2.7	7	1.7				
Mountain sucker	9	1.0	25	1.1			3	2.7	93	8.1
Sucker spp.	340	37.7	453	19.4	1	0.2	14	12.7	76	6.6
White sucker	1	0.1	10	0.4			2	1.8	1	0.1
Total	**903**	**100.0**	**2331**	**100.0**	**416**	**100.0**	**110**	**100.0**	**115**	**100.0**

In the Milk River, species composition was similar between summer and fall for the dominant species. Flathead chub represented 66% of the catch during summer and 61% during fall. Sucker species represented 26% of the catch during summer and 27% during fall, while longnose dace represented 7% of the catch during summer and 8% during fall (Table 3.4).

During summer, only the lower Milk River was sampled and capture effort focussed on western silvery minnows. Previous studies have indicated that the western silvery minnow is primarily found in the lower sections of the Milk River. Other species of interest, such as St. Mary sculpin are not commonly found in this area.

During summer, the species of interest encountered included western silvery minnow and sauger (both representing 0.4% of the catch). However during fall, all five species of interest were encountered: St. Mary sculpin (1.8% of the catch), sauger (0.8%), western silvery minnow (0.5%), stonecats (0.4%), and brassy minnow (<0.1%; Table 3.4).

Table 3.3 Overall percent composition of fish species encountered in the Milk and St. Mary drainages, 2001.

Species	Milk River		St. Mary River		Lee Creek	
	No.	Percent	No.	Percent	No.	Percent
Brassy minnow	1	0.0				
Sauger	55	0.7				
St. Mary sculpin	118	1.5	85	73.9	17	22.4
Stonecat	29	0.4				
Western silvery minnow	39	0.5				
Brook stickleback	1	0.0				
Burbot	2	0.0				
Cutthroat trout					1	1.3
Flathead chub	4843	62.0				
Lake chub	20	0.3				
Longnose dace	584	7.5	13	11.3	38	50.0
Mountain whitefish			2	1.7	1	1.3
Rainbow trout					3	3.9
Trout-perch	14	0.2	1	0.9		
Longnose sucker	131	1.7				
Sucker spp.	1738	22.2	14	12.2	16	21.1
White sucker	242	3.1				
Total	**7817**	**100.0**	**115**	**100.0**	**76**	**100.0**

3.1.2 Fish Distribution

St. Mary sculpin

In the Milk River, St. Mary sculpin were widely distributed in the mainstem; however, they were absent from the catch in the lowermost section (Figure 3.1). In the St. Mary River upstream of the reservoir, this species was recorded at all sampling locations. In Lee Creek, St. Mary sculpin were documented in the lower section (as far as 6 km upstream of Cardston).

All Other Species of Interest

During the present study, stonecats were documented in the mid- and lower sections of the Milk River (Figure 3.1). Western silvery minnow in contrast, appeared to be limited in distribution to the lower Milk River. The distribution of brassy minnow appeared to be limited to the mid-section of the Milk River, near the Town of Milk River and downstream of the Aden Bridge (Figure 3.2). Sauger were also recorded in the mid-section near the Aden Bridge but this species was also present in the lower Milk River near the Pinhorn Ranch.

Table 3.4 Seasonal percent composition of fish species encountered in the Milk and St. Mary drainages, 2001.

Species	Milk River				St. Mary River		Lee Creek	
	Summer		Fall		Fall		Fall	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Brassy minnow			1	0.0				
Sauger	4	0.4	51	0.8				
St. Mary sculpin			118	1.8	85	73.9	17	22.4
Stonecat			29	0.4				
Western silvery minnow	4	0.4	35	0.5				
Brook stickleback			1	0.0				
Burbot			2	0.0				
Cutthroat trout							1	1.3
Flathead chub	746	65.7	4097	61.3				
Lake chub			20	0.3				
Longnose dace	83	7.3	501	7.5	13	11.3	38	50.0
Mountain whitefish					2	1.7	1	1.3
Rainbow trout							3	3.9
Trout-perch			14	0.2	1	0.9		
Longnose sucker			131	2.0				
Sucker spp.	299	26.3	1439	21.5	14	12.2	16	21.1
White sucker			242	3.6				
Total	**1136**	**100.0**	**6681**	**100.0**	**115**	**100.0**	**76**	**100.0**

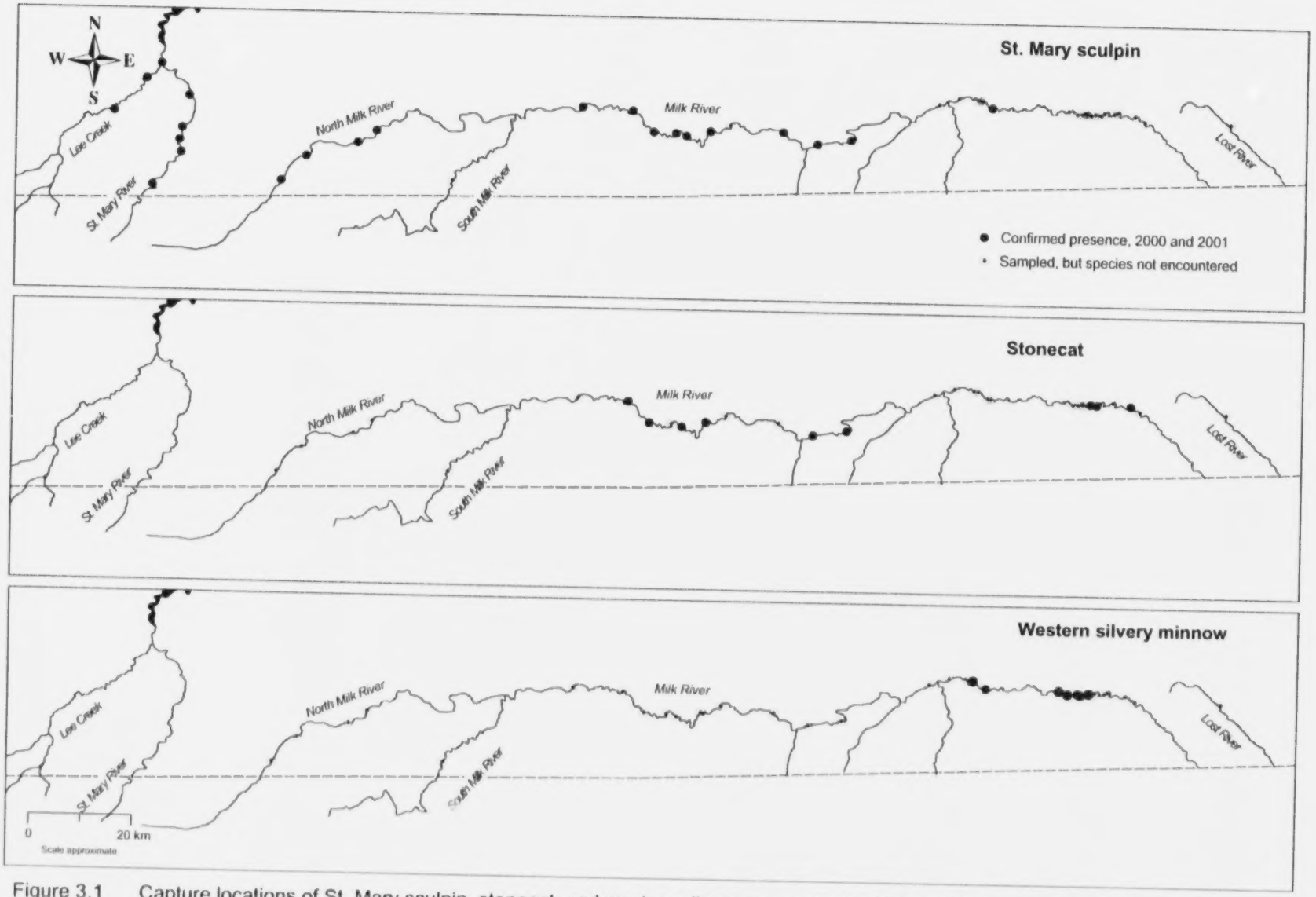

Figure 3.1 Capture locations of St. Mary sculpin, stonecat, and western silvery minnow in the Milk and St. Mary drainages, 2000-2001.

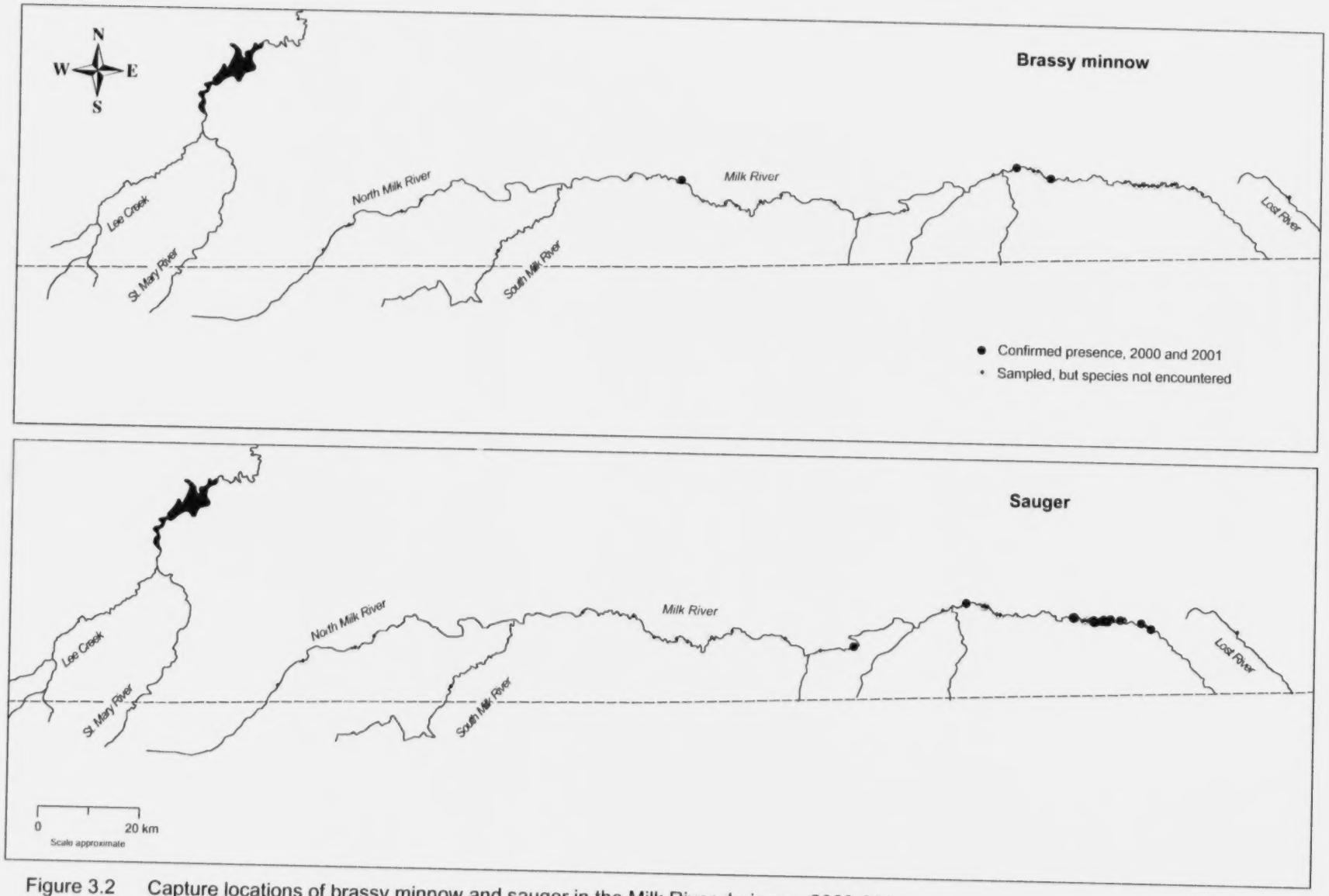

Figure 3.2 Capture locations of brassy minnow and sauger in the Milk River drainage, 2000-2001.

3.1.3 Relative Fish Abundance

Backpack electrofishing and beach seining were the two main sampling methods used to calculate relative fish abundance during 2000 and 2001 (for details of sampling methods and effort, see Appendix D). This section outlines the results for two categories: abundance by drainage and abundance by site.

3.1.3.1 Relative Abundance by Drainage

2000

The overall relative abundance during backpack electrofishing was 5.1 fish/min in the Milk River and 9.5 fish/min in the St. Mary River. In Lee Creek, the overall relative abundance was considerably higher at 53.5 fish/min (Table 3.5).

The relative abundance of most species varied seasonally. In the Milk River during summer, St. Mary sculpin had the highest relative abundance (0.7 fish/min), while longnose dace were second in abundance (0.5 fish/min). During fall, both longnose dace and St. Mary sculpin were similar in abundance (2.0 and 1.8 fish/min, respectively). In general, the relative abundance of most fish species in the Milk River was higher during fall than summer, with the exception of brassy minnow (Table 3.5).

In the St. Mary River, longnose dace exhibited the highest relative abundance (7.5 fish/min) during summer, followed by St. Mary sculpin (2.4 fish/min; Table 3.5). During fall, the opposite was true; St. Mary sculpin had the highest abundance (4.2 fish/min), followed by longnose dace (2.0 fish/min). Lee Creek was sampled only during summer, and longnose dace were by far the most abundant species (43.7 fish/min) at this time.

According to the summer beach seining results in the Milk River, longnose dace had the highest relative abundance (9.7 fish/100 m^2), followed by sucker species (all species combined = 8.5 fish/100 m^2), and flathead chub (0.8 fish/100 m^2; Table 3.6). During fall, flathead chub exhibited the highest abundance (26.9 fish/100 m^2), followed by sucker species (10.5) and longnose dace (3.3). In the St. Mary River, only longnose dace and St. Mary sculpin were captured by beach seine. Longnose dace had the highest abundance during both seasons (5.8 and 0.7 fish/100 m^2 during summer and fall, respectively; Table 3.6). Beach seining was not conducted in Lee Creek due to the coarse substrate present.

2001

In 2001, backpack electrofishing was only conducted during the fall session. The overall catch-per-unit-effort in the Milk River during this time was 10.7 fish/min, while the catch effort in the St. Mary River was 4.2 fish/min and 13.3 fish/min in Lee Creek (Table 3.7). Flathead chub contributed the most to the catch in the Milk River (5.5 fish/min). Whereas St. Mary sculpin (3.1 fish/min) and longnose dace (6.6 fish/min) contributed the most to the catches in the St. Mary River and Lee Creek, respectively.

Of the species of interest, St. Mary sculpin had a relative abundance of 0.7 fish/min in the Milk River, while in the St. Mary River and Lee Creek, St. Mary sculpin exhibited CPUE values of 3.1 and 3.0 fish/min, respectively (Table 3.7). All other species of interest encountered in the Miik River during backpack electrofishing had CPUE values <0.3 fish/min.

Beach seining results obtained during summer in the lower Milk River indicated that flathead chub was the most abundant species (22.9 fish/100 m^2), followed by sucker species (9.2 fish/100 m^2; Table 3.8). Western silvery minnow and sauger both had low CPUE values (0.1 fish/100 m^2) during summer. During fall, flathead chub exhibited the highest abundance (285.8 fish/100 m^2), followed by sucker species (132.5 fish/100 m^2). Of the Species of Concern, western silvery minnow was the most abundant (3.0 fish/100 m^2), while sauger (1.4 fish/100 m^2) and St. Mary sculpin (0.1 fish/100 m^2) had considerably lower CPUE values.

Table 3.5 Seasonal relative abundance (no. fish/min) of fish species encountered by backpack electrofishing in the Milk and St. Mary drainages, 2000.

Species	Milk River			St. Mary River			Lee Creek
	Summer	Fall	Overall	Summer	Fall	Overall	Summer
Effort	(42 min)	(142 min)	(184 min)	(36 min)	(14 min)	(49 min)	(22 min)
Brassy minnow	0.02		0.01				
Sauger		0.13	0.10				
St. Mary sculpin	0.65	1.83	1.56	2.42	4.15	2.89	1.53
Stonecat		0.24	0.18				
Burbot		0.02	0.02				
Cutthroat trout							0.14
Rainbow trout							0.09
Mountain whitefish		0.01	0.01				
Flathead chub	0.19	0.58	0.49				
Lake chub		0.04	0.03				0.05
Longnose dace	0.48	2.00	1.66	7.46	2.00	5.97	43.73
Trout-perch		0.01	0.01	0.08	0.37	0.16	
Unidentified				0.03		0.02	0.05
Longnose sucker	0.07	0.38	0.31				
Mountain sucker	0.05	0.17	0.14		0.22	0.06	4.32
Sucker spp.		0.70	0.54	0.03	1.04	0.30	3.53
White sucker		0.05	0.04		0.15	0.04	0.05
Total	**1.46**	**6.14**	**5.08**	**10.02**	**7.93**	**9.45**	**53.49**

3.1.3.2 Relative Abundance by Site

Backpack Electrofishing

St. Mary sculpin

Milk River

During the summer 2000 sampling program, 10 sites were sampled in the Milk River. St. Mary sculpin were captured at only four of these sites. However during fall, this species was encountered at a greater number of sites (i.e., recorded at 13 of 18 sites).

During summer, the catch-per-unit-effort (CPUE) of St. Mary sculpin was highest in the North Milk River (Sites 7 to 10; Figure 3.3). During fall, St. Mary sculpin were more widely

distributed throughout the Milk River. Similar to the summer results, their abundance was highest in the North Milk River and then decreased steadily in the downstream section (Figure 3.3).

Table 3.6 Seasonal relative abundance (no. fish/100 m^2) for fish species captured by beach seining in the Milk and St. Mary drainages, 2000.

Species	Milk River			St. Mary River		
	Summer	Fall	Total	Summer	Fall	Total
Effort	(4304 m^2)	(3480 m^2)	(7784 m^2)	(450 m^2)	(300 m^2)	(750 m^2)
Brassy minnow		0.23	0.1			
Sauger	0.02		0.01			
St. Mary sculpin	0.26	0.46	0.35	0.22	0.33	0.27
Western silvery minnow		0.06	0.03			
Burbot	0.02		0.01			
Flathead chub	0.84	26.93	12.50			
Lake chub	0.09	0.34	0.21			
Longnose dace	9.69	3.28	6.82	5.78	0.67	3.73
Unidentified		0.03	0.01			
Longnose sucker	0.49	0.26	0.39			
Mountain sucker	0.16	0.09	0.13			
Sucker spp.	7.85	10.17	8.89			
White sucker		0.09	0.04			
Total	**19.42**	**41.93**	**29.48**	**6.00**	**1.00**	**4.00**

During the 2001 sampling program, the summer session focused on the lower Milk River, where St. Mary sculpin is not prevalent. During fall, a total of 20 sites were sampled throughout the Milk River and St. Mary sculpin were encountered at six of those sites. Of the sites sampled during fall, the presence of St. Mary sculpin was expected at seven sites. The abundance of St. Mary sculpin was highest in the mid to upper sections of the Milk River (Figure 3.3).

St. Mary River and Lee Creek

During the 2000 sampling program in the St. Mary River, six sites were sampled during summer and two sites during fall. St. Mary sculpin were captured at all sites during both seasons. No trends in relative abundance were apparent throughout the sections sampled (Figure 3.4). CPUE values for this species ranged from 0.5 fish/min at Site 14 to 8.0 fish/min at Site 13. Of the two sites sampled during both seasons, the abundance of St. Mary sculpin was greater during fall.

In Lee Creek during the 2000 sampling program, four sites were sampled during summer (this system was not sampled during fall). St. Mary sculpin were captured only at the two downstream sites (Sites 19 and 20; Figure 3.4). CPUE values determined for these two sites (2.5 vs. 16.6 fish/min) varied considerably. In fact, CPUE at Site 19 (16.6 fish/min) was the highest recorded value for any of the species of interest throughout the entire study area.

Table 3.7 Relative abundance (no. fish/min) of fish species encountered by backpack electrofishing in the Milk and St. Mary drainages, October 2001.

Effort / Species	Milk River (176.2 min)		St. Mary River (27.7 min)		Lee Creek (5.7 min)	
	No. of fish	CPUE[a]	No. of fish	CPUE	No. of fish	CPUE
Sauger	36	0.2				
St. Mary sculpin	117	0.7	85	3.1	17	3.0
Stonecat	29	0.2				
Western silvery minnow	2	0.0				
Burbot	2	0.0				
Cutthroat trout					1	0.2
Flathead chub	976	5.5				
Lake chub	20	0.1				
Longnose dace	341	1.9	13	0.5	38	6.6
Mountain whitefish			2	0.1	1	0.2
Rainbow trout					3	0.5
Trout-perch	2	0.0	1	0.0		
Longnose sucker	49	0.3				
Sucker spp.	307	1.7	14	0.5	16	2.8
White sucker	9	0.1				
Total	**1890**	**10.7**	**115**	**4.2**	**76**	**13.3**

[a] CPUE = Catch-per-unit-effort.

During the 2001 sampling program two index sites were sampled in the St. Mary River during fall and one site in Lee Creek. In the St. Mary River, the relative abundance of St. Mary sculpin was 2.2 fish/min at Site 12 and 4.7 fish/min at Site 15, while the relative abundance of this species in Lee Creek at the Town of Cardston was 3.0 fish/min (Figure 3.4).

Stonecat, Sauger, Brassy Minnow, and Western Silvery Minnow

2000

During backpack electrofishing surveys, stonecat were recorded from the Coffin Bridge area downstream to the Pinhorn Ranch (Site 27 and Site 1, respectively; Figure 3.5). Abundance of stonecat ranged from 0.2 to 1.5 fish/min. Similarly, sauger were primarily found in the downstream reaches of the Milk River (Sites 2 and 23). The highest CPUE for sauger in the

Milk River was 3.5 fish/min, near the Aden Bridge. The brassy minnow was captured only at Site 4 and their abundance was low (0.1 fish/min).

2001

The capture distribution of the stonecat increased in 2001; stonecat were recorded in the Milk River from the Town of Milk River downstream to the Pinhorn Ranch (Site 4 and Site 42; Figure 3.5). CPUE values for stonecat ranged from 0.1 to 1.8 fish/min. Sauger were primarily found in the downstream reaches of the Milk River near the Pinhorn Ranch (Sites 1, 36, 40-42, and 45). The highest CPUE recorded for sauger in the Milk River during 2001 was 1.4 fish/min. The western silvery minnow was only captured at Site 36 and was present in low numbers (i.e., CPUE of 0.2 fish/min). Brassy minnow was not captured during backpack electrofishing.

Table 3.8 Seasonal relative abundance (no. fish/100 m^2) of fish species captured by beach seining in the Milk River, 2001.

Species	Milk River		
	Summer	Fall	Overall
Effort	(3252 m^2)	(1092 m^2)	(4344 m^2)
Brassy minnow		0.1	
Sauger	0.1	1.4	0.4
St. Mary sculpin		0.1	
Western silvery minnow	0.1	3.0	0.9
Brook stickleback		0.1	
Flathead chub	22.9	285.8	89.0
Longnose dace	2.6	14.7	5.6
Trout-perch		1.1	0.3
Longnose sucker		7.5	1.9
Sucker spp.	9.2	103.7	32.9
White sucker		21.3	5.4
Total	**34.9**	**438.7**	**136.4**

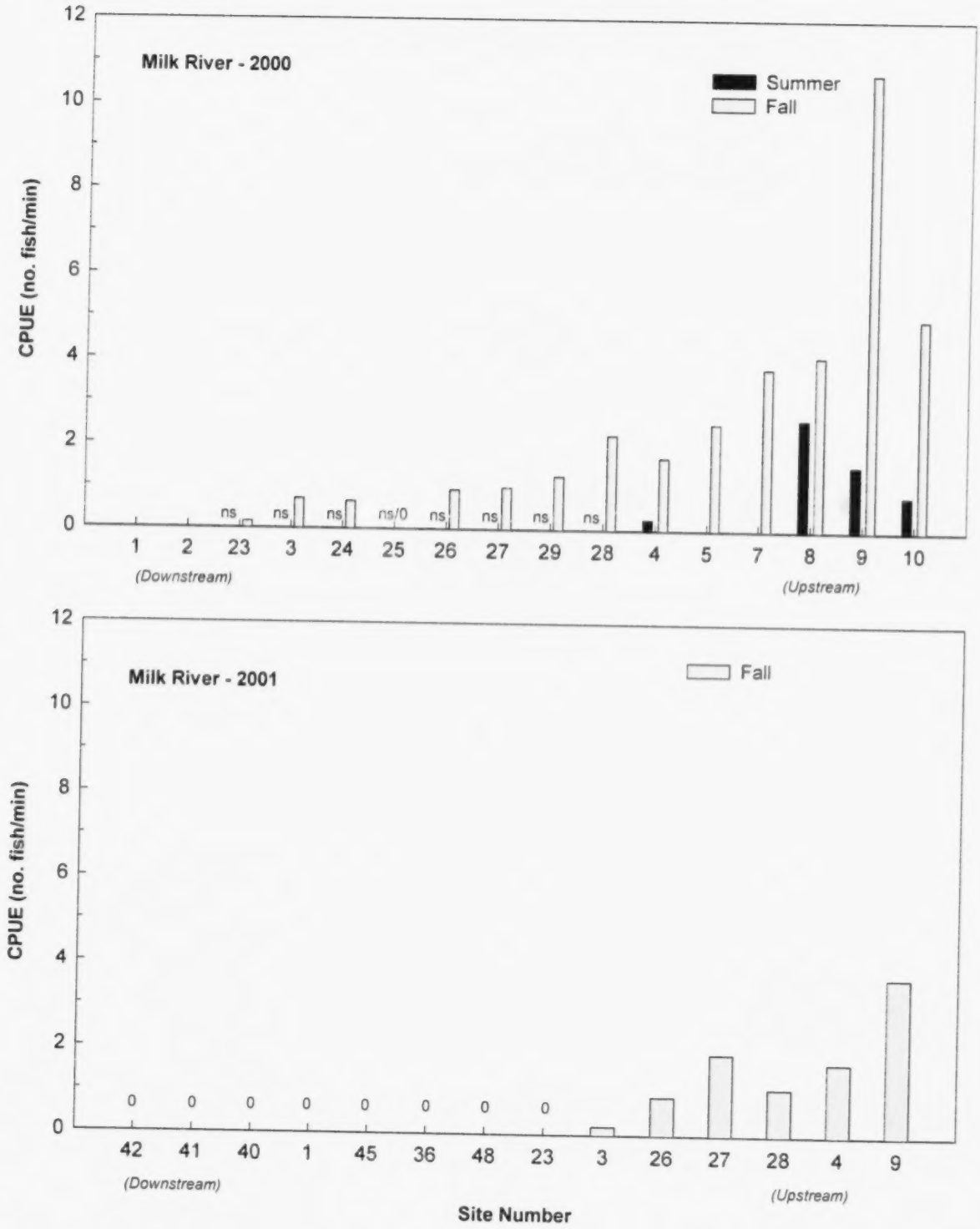

Figure 3.3 Relative abundance (no. fish/min) of St. Mary sculpin captured using backpack electrofishing in the Milk River, 2000 and 2001.

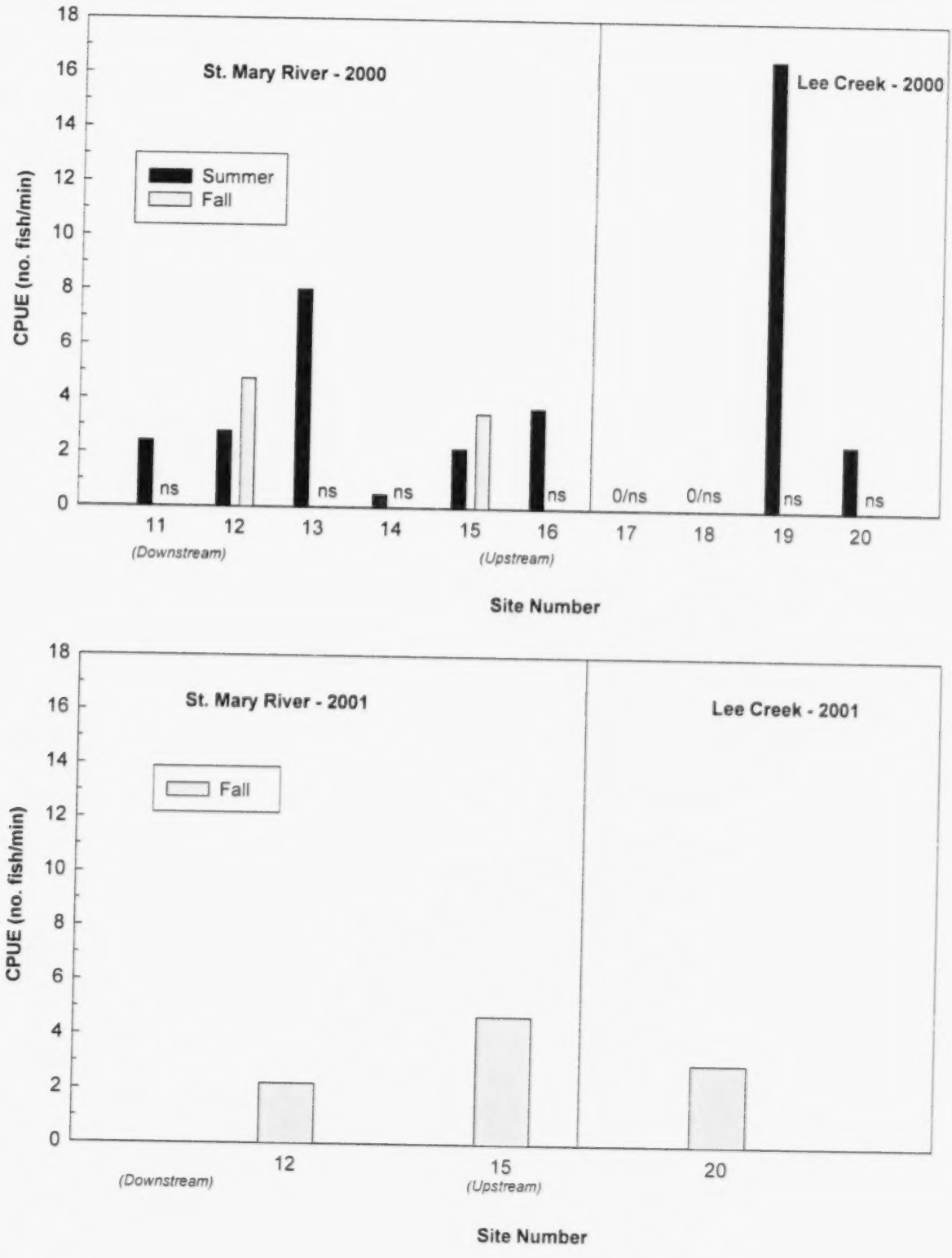

Figure 3.4 Relative abundance (no. fish/min) of St. Mary sculpin captured using backpack electrofishing in the St. Mary drainage, 2001.

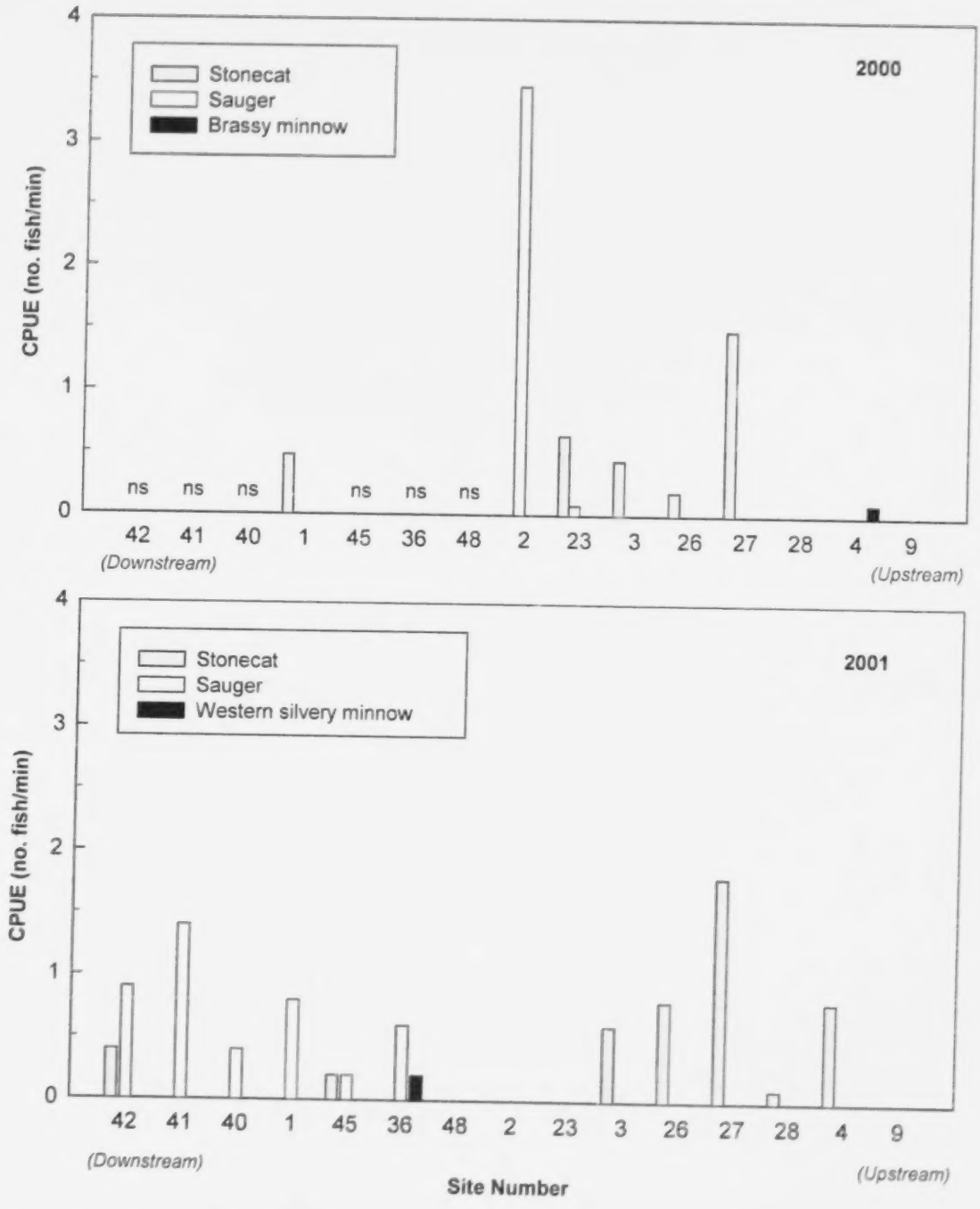

Figure 3.5 Relative abundance (no. fish/min) of stonecat, sauger, western silvery minnow, and brassy minnow captured using backpack electrofishing in the Milk River, fall 2000 and 2001.

Beach seining

All species of interest except stonecats were captured using beach seines. Beach seining was the most effective sample method during summer in the Milk River due to the substrate composition (i.e., sand) and high turbidity. Turbidity levels were considerably lower during fall 2000, and thus beach seining was not as effective. However, during the fall 2001, beach seining was very effective since most of the water in the lower Milk River was in isolated pools.

2000

St. Mary sculpin were only captured in the three upper North Milk River sites (Sites 7 to 9), with CPUE values ranging from 0.5 to 3.3 fish/100 m^2 (Table 3.9). However, during fall, St. Mary sculpin were only captured in the mid-section at Sites 3, 4 and 5; CPUE values ranged from 1.3 to 6.7 fish/100 m^2. Due to the very low flows during fall and large substrate, beach seining was not conducted in the North Milk River. In the St. Mary River, beach seining was difficult due to the large substrate; however, it was feasible at Site 12 during fall (0.7 fish/100 m^2) and at Site 15 during summer (0.7 fish/100 m^2).

Sauger was the only species of interest captured during summer using beach seines. This species was captured in the farthest downstream site on the Milk River (Site 1) and was present in low numbers (0.7 fish/100 m^2). During fall, western silvery and brassy minnows were captured using beach seines. Both species were found in the downstream sections of the Milk River. CPUE value recorded for the western silvery minnow was 1.2 fish/100 m^2 (Site 21), while the brassy minnow had a CPUE of 5.3 fish/100 m^2 (Site 22; Table 3.9).

Table 3.9 Relative abundance (no. fish/100 m^2) by site for fish species captured using beach seines in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Summer		Fall		
		Sauger	St. Mary sculpin	Brassy Minnow	St. Mary sculpin	Western Silvery Minnow
Milk River	1	0.67				
(Downstream)	21	ns	ns			1.22
	22	ns	ns	5.33		
	2					
	3				1.33	
	24	ns	ns			
	4	ns	ns		6.67	
	5				2.67	
	7		0.52	ns	ns	ns
(Upstream)	8		3.00	ns	ns	ns
	9		3.33	ns	ns	ns
St. Mary River	12	-		-	0.67	-
	15	-	0.67	-	ns	-

2001

Beach seining during the 2001 summer and fall sessions focussed on the lower Milk River. During both seasons, beach seining was only conducted near the Pinhorn Ranch and Ross' Ranch.

St. Mary sculpin was not encountered in beach seines during summer in the lower Milk River, however one specimen was captured during fall near Ross' Ranch (Site 51; Table 3.10). Sauger were captured with beach seines at two sites in summer and three sites in fall. All sites where sauger were encountered were within the Pinhorn Ranch area (Sites 21, 31, 36, 46, and 47). Of these, the highest abundance was recorded at Site 21, with 3.7 fish/100 m^2. Western silvery minnow were captured at two sites in summer and seven sites in fall. Two of the sites during fall were located upstream near the Ross' Ranch (Sites 49 & 50), while the remainder of the sites were located with the Pinhorn Ranch area (Table 3.10). The highest CPUE value for western silvery minnow was recorded at Site 47 (8.0 fish/100 m^2). Brassy minnow was only captured at one site (Site 50), where the catch effort was 1.3 fish/100 m^2.

Table 3.10 Relative abundance (no. fish/100 m^2) by site for fish species captured using beach seines in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Summer		Fall			
		Sauger	Western Silvery Minnow	Brassy Minnow	Sauger	St. Mary Sculpin	Western Silvery Minnow
Milk River	31	0.7					
(Downstream)	21				3.7		4.8
	47				0.3		8.0
	32						
	30						
	36	1.1	3.3				
	46				2.7		0.3
	33						3.3
	35						
	34						
	39						
	38						
	37		0.3				0.3
	50			1.3			1.3
	51					1.2	
(Upstream)	49						4.0

3.1.4 Life History Characteristics

This section provides descriptive statistics of fork length by site for the species of interest and statistical comparisons of fork length to assess reach differences in length. Life history data for the species of interest are provided in Appendix D.

2000

St. Mary sculpin in the Milk River (n=234) had a mean fork length of 56 mm, with a minimum and maximum fork length of 19 mm and 114 mm, respectively. In the St. Mary River, the mean fork length (n=118) was 51 mm (lengths ranged from 19 mm to 99 mm). The mean fork length of St. Mary sculpin in Lee Creek (n=29) was smaller than the other two drainages (40 mm, with a range of 26 to 76 mm).

Length frequency histograms for St. Mary sculpin in the Milk and St. Mary rivers and Lee Creek are presented in Figure 3.6. A unimodal distribution was apparent in the three drainages. In the Milk River, the 50 - 59 mm length category represented the highest frequency, while in the St. Mary River and Lee Creek, the 30 – 39 mm interval was most common.

Stonecats (n=24) were captured at five sites in the Milk River. The mean fork length was 132 mm (lengths ranged from 32 to 269 mm). Western silvery minnow (n=2) were captured at one site and the mean fork length of the sample was 41 mm. Brassy minnow (n=9) were captured at two sites; the mean fork lengths at each site were 26 and 48 mm (Sites 22 and 4, respectively). Sauger (n=7) were captured at three sites, where fork lengths ranged from 343 to 458 mm (mean of 381 mm) at these sites.

A one-way ANOVA was performed to determine if there were differences between sites with respect to the fork length for each of the species of interest. This analysis could not be performed on western silvery minnow because this species was captured only at one site. Results of the ANOVA indicated that there were significant differences in fork length between sites for brassy minnow, stonecats, and St. Mary sculpin in the Milk River, and St. Mary sculpin in the St. Mary River ($P<0.05$). No significant differences in fork length between sites were documented for sauger in the Milk River and St. Mary sculpin in Lee Creek.

For St. Mary sculpin in the Milk River, Site 9 contributed primarily to the significant results (this site was only significantly different from Sites 3, 7, and 28; Table 3.11); all other sites were not significantly different. The reason for this was that Site 9 had the lowest mean fork length of all the sites analysed (46 mm). In the St. Mary River, there were two groupings of sites for St. Mary sculpin that did not exhibit significantly different fork lengths. The first grouping was Sites 12, 13, and 15, which had mean fork lengths of >50 mm, while the second grouping was Sites 14 and 16, which had mean fork lengths of <40 mm (Table 3.11). Site 11 had a mean fork length that was not significantly different from either of the two other groupings. In the Milk River, brassy minnow were smaller in the downstream site (Site 22) than the upstream site (Site 4; Table 3.11). For stonecats, Site 1 contributed primarily to the significant results. Stonecats at this site had the highest mean fork length (246 mm).

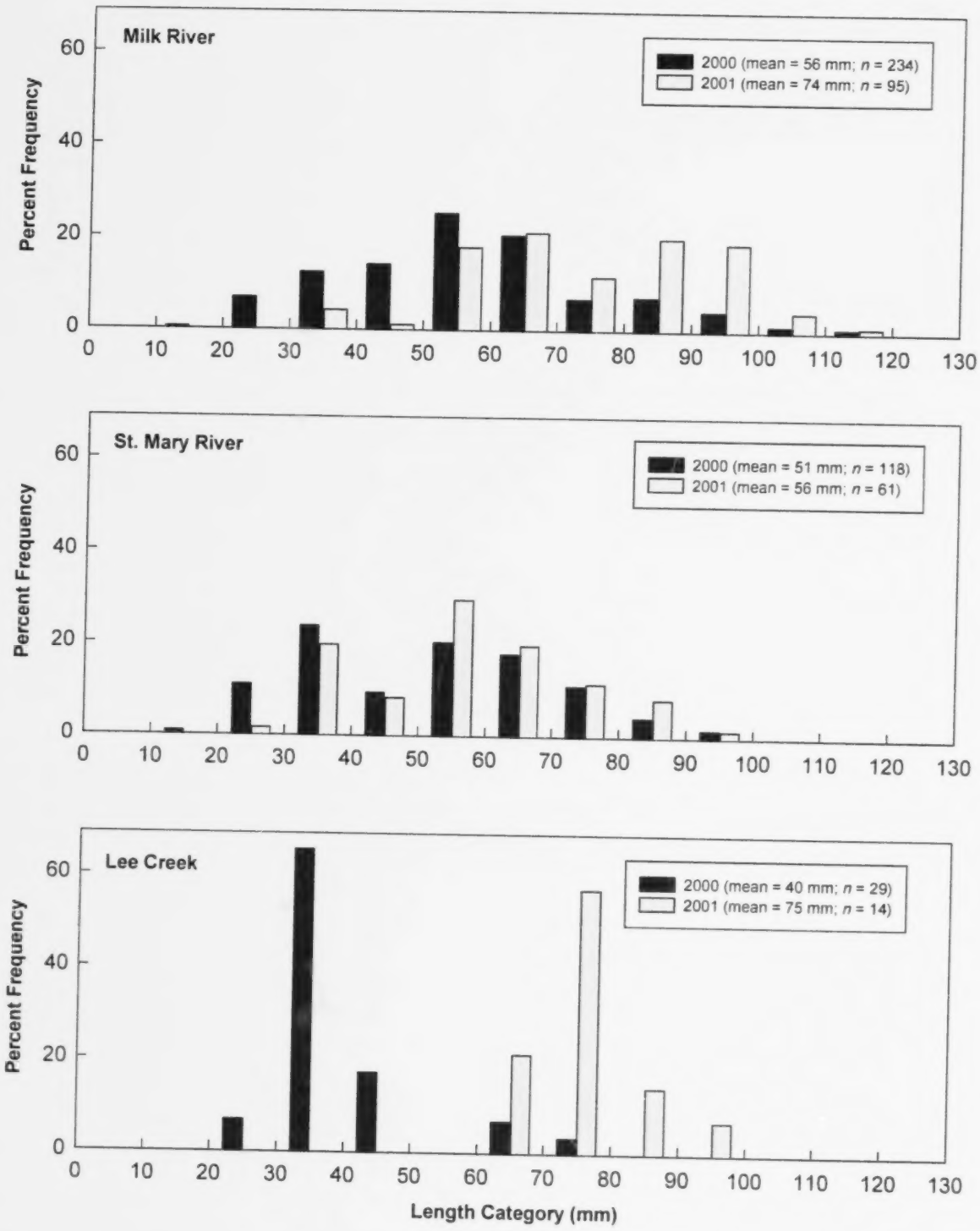
Milk River
2000 (mean = 56 mm; n = 234)
2001 (mean = 74 mm; n = 95)
Percent Frequency
St. Mary River
2000 (mean = 51 mm; n = 118)
2001 (mean = 56 mm; n = 61)
Percent Frequency
Lee Creek
2000 (mean = 40 mm; n = 29)
2001 (mean = 75 mm; n = 14)
Percent Frequency
Length Category (mm)

Figure 3.6 Length frequency distribution of St. Mary sculpin captured in the Milk and St. Mary drainages, 2000 and 2001.

Table 3.11 Length differences between sample sites in 2000 for the species of interest in the Milk and St. Mary rivers using a one-way ANOVA (Significance level was P<0.05).

Waterbody	Species	Parameter	*(Downstream)*												*(Upstream)*
Milk River	St. Mary sculpin	Site No.	23	3	24	25	27	29	28	4	5	7	8	**9**	10
		Significance	AB	A	AB	AB	AB	AB	A	AB	AB	A	AB	**B**	AB
		Mean FL	71	61	58	53	79	70	76	56	57	61	50	**46**	56
		n	2	10	4	6	8	10	12	25	15	27	31	**50**	34
St. Mary	St. Mary sculpin	Site No.	**16**	15	**14**	13	12	11							
		Significance	**A**	B	**A**	B	B	AB							
		Mean FL	**39**	57	**25**	58	53	39							
		n	**18**	24	**3**	26	36	10							
Milk River	Brassy minnow	Site No.	22	4											
		Significance	A	B											
		Mean FL	29	48											
		n	8	1											
Milk River	Stonecat	Site No.	**1**	23	3	26	27								
		Significance	**A**	B	AB	AB	B								
		Mean FL	**246**	118	88	165	99								
		n	**4**	6	3	2	9								

2001

St. Mary sculpin in the Milk River (*n*=95) had a mean fork length of 74 mm, with a minimum and maximum fork length of 33 mm and 110 mm, respectively. In the St. Mary River, the mean fork length (*n*=61) was 56 mm (lengths ranged from 28 to 96 mm). Similar to the Milk River, the mean fork length of St. Mary sculpin in Lee Creek (*n*=14) was 75 mm, with a minimum fork length of 60 mm and maximum of 90 mm.

Length frequency histograms of St. Mary sculpin for the Milk and St. Mary rivers and Lee Creek are presented in Figure 3.6. A unimodal distribution was apparent in the three drainages. In the Milk River, the 60 - 69 mm length category represented the highest frequency. In the St. Mary River, the 50 - 59 mm interval was most common, while St. Mary sculpin in Lee Creek were generally larger than the other two drainages, with the highest length frequency in the 70-79 mm group.

Stonecats were captured at seven sites in the Milk River. The mean fork length of stonecats was 152 mm, with a range of 80 mm to 225 mm (Figure 3.7). Western silvery minnow were captured at seven sites, where the mean fork length was 97 mm (minimum and maximum fork lengths of 29 and 140 mm). Brassy minnow were captured at one site, where the fork length was 35 mm. The mean fork length of sauger at 10 sites was 123 mm (values ranged from 76 to 558 mm; Figure 3.7).

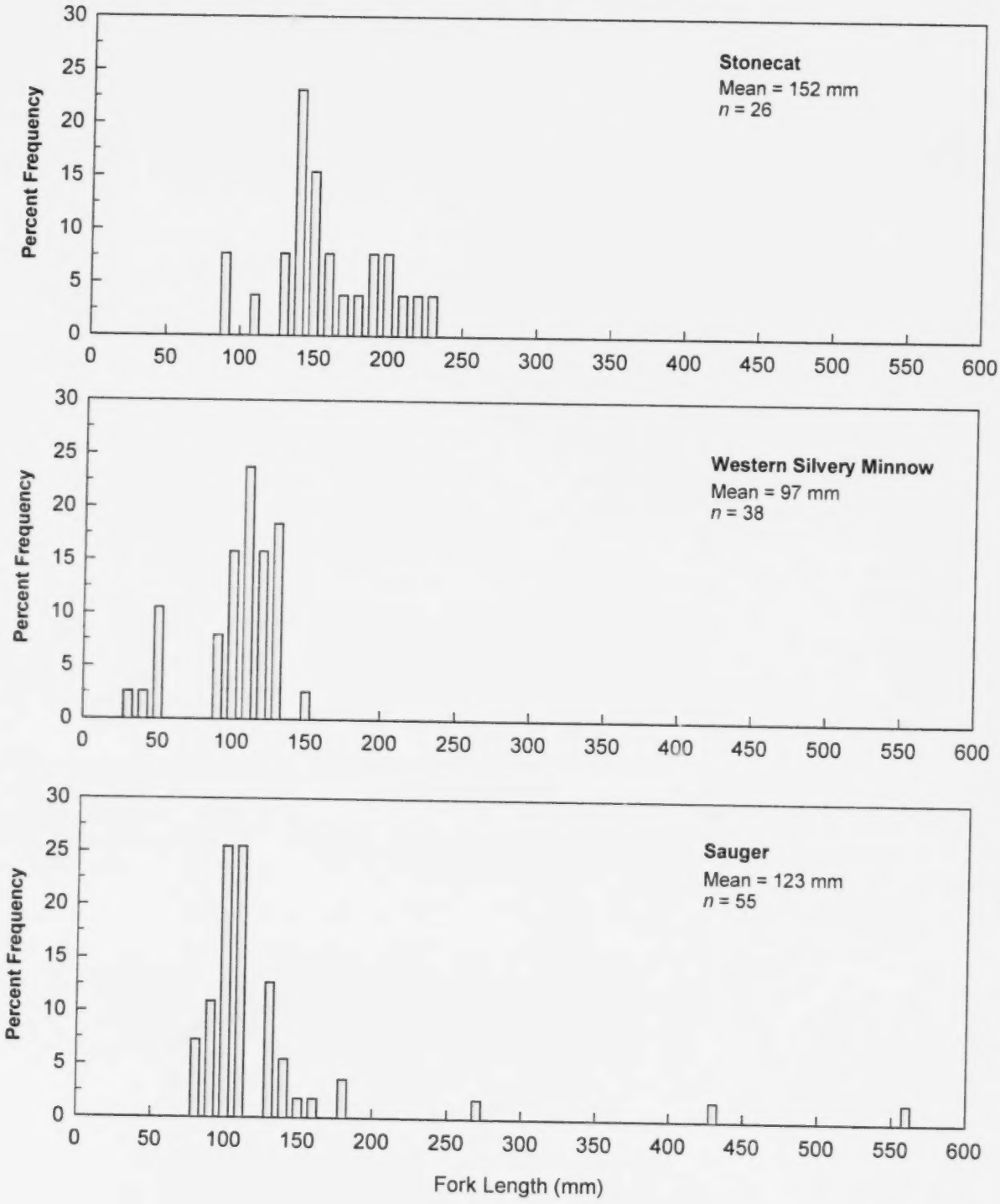

Figure 3.7 Length frequency distribution of stonecat, western silvery minnow and sauger captured in the Milk and St. Mary drainages, 2001.

A one-way ANOVA was performed to determine if there were differences between sites with respect to the fork length for each of the species of interest. This analysis could not be performed on brassy minnow since this species was captured only at one site. Results of the ANOVA indicate that there were significant differences in fork length between sites for St. Mary sculpin, sauger, and western silvery minnow in the Milk River ($P<0.05$; Table 3.12). No significant differences in fork length between sites were documented for stonecat in the Milk River and St. Mary sculpin in the St. Mary River.

For St. Mary sculpin in the Milk River, Site 9 contributed primarily to the significant results; all sites except Site 3 were significantly different (Table 3.12). The reason for this difference was that Site 9 had the lowest mean fork length of all the sites analyzed (60 mm). For sauger, there were three groupings of sites that exhibited significant differences in fork lengths. In particular, two of the sites were noticeably different from the other sites (Sites 31 and 47). Site 31 was in the lowest size category, with a mean fork length of 77 mm, while Site 47 contributed to one of the higher size categories. Site 40 had a mean fork length that was not significantly different from any of the other sites. For western silvery minnow, only one site contributed to the significant difference (Site 36); silvery minnows at this site were considerably smaller (mean fork length of 43 mm versus means >100 mm for all other sites; Table 3.12).

Table 3.12 Length differences between sample sites in 2001 for the species of interest in the Milk and St. Mary rivers using a one-way ANOVA (Significance level was $P<0.05$).

Waterbody	Species	Parameter	*(Downstream)*							*(Upstream)*
Milk River	Sauger	Site No.	42	41	40	1	**31**	21	47	36
		Significance	A	A	ABC	AC	**B**	AC	C	A
		Mean FL	101	97	287	108	**77**	117	142	96
		n	9	4	5	11	**3**	10	4	7
Milk River	St. Mary sculpin	Site No.	26	27	28	3	4	**9**		
		Significance	A	A	A	AB	A	**B**		
		Mean FL	83	78	82	71	82	**60**		
		n	6	17	30	3	11	**27**		
St. Mary	St. Mary sculpin	Site No.	15	12						
		Significance	A	A						
		Mean FL	54	60						
		n	40	21						
Milk River	Stonecat	Site No.	42	27	28					
		Significance	A	A	A					
		Mean FL	170	141	135					
		n	4	15	3					
Milk River	Western silvery minnow	Site No.	21	**36**	47	49				
		Significance	A	**B**	A	A				
		Mean FL	104	**43**	109	114				
		n	13	**5**	11	6				

3.2 Habitat

3.2.1 Physical and Chemical Characteristics

A range of physical and chemical characteristics were recorded in the Milk and St. Mary drainages during the 2000-2001 field program (Tables 3.13 and 3.14). Parameters included water temperature, conductivity, pH, turbidity, dissolved oxygen, and discharge. Site-specific data are presented in Appendix E. As expected water temperature, discharge, and turbidity were lower during the fall surveys. Dissolved oxygen was higher during fall and pH was similar between seasons.

Table 3.13 Summary of physical and chemical characteristics in the Milk River, August and October, 2000.

Month	Parameter	N	Mean	Minimum	Maximum
August	Temperature (°C)	10	21.3	18.90	26.5
	Conductivity (µS)	10	130	100	170
	pH	10	8.3	6.5	8.6
	Turbidity (NTU)	10	14.1	0.7	52.7
	Dissolved Oxygen (mg/L)	10	8.1	7.4	9.0
	Discharge[a] (m^3/s)	6	16.87	16.27	18.07
October	Temperature (°C)	18	7.2	2.1	11.0
	Conductivity (µS)	18	422	270	570
	pH	16	8.4	6.2	8.8
	Turbidity (NTU)	18	1.7	1.1	3.3
	Dissolved Oxygen (mg/L)	17	11.0	9.5	12.1
	Discharge[a] (m^3/s)	7	1.18	1.03	1.36

[a] See Appendix E for data pertaining to the St. Mary River and Lee Creek; discharge value from the Town of Milk River (WSC Station No. 11AA0005).

Water temperatures varied slightly between location and year. In 2000, the lower Milk River (Site 2) exhibited slightly warmer water temperatures than the upper Milk River (Site 7; Figure 3.8; see Appendix E for raw data). Water temperatures at Site 2 were recorded in 2000 and 2001. The results indicate that temperatures were on average 0.33 °C warmer in 2001 (sum of the difference between the two years). There were four periods where water temperatures during 2001 were higher than in 2000; these periods had means of 0.6 °C to 2.7 °C warmer. There were five periods where water temperature was cooler in 2001 than in 2000; these periods had means of 0.5 °C to 3.3 °C cooler.

At Site 2, maximum water temperatures were 27 °C in 2000 (8 August) and 28 °C in 2001 (16 July), while minimum water temperatures were 8 °C in 2000 (October 6-8 & 22) and 0.8 °C in 2001 (19 October). At Site 7 in 2000, minimum water temperature was 2.5 °C and maximum water temperature was 21°C.

Table 3.14 Summary of physical and chemical characteristics in the Milk River, July and October, 2001.

Month	Parameter	N	Mean	Minimum	Maximum
July	Temperature (°C)	9	21.6	21.0	23.0
	Conductivity (µS)	9	124.4	120.0	130.0
	pH	9	7.8	7.8	8.2
	Turbidity (NTU)	5	47.9	6.4	76.7
	Dissolved Oxygen (mg/L)	2	7.7	7.3	8.2
	Discharge[a] (m^3/s)	3	15.3	15.2	15.5
October	Temperature (°C)	16	6.0	2.5	10.3
	Conductivity (µS)	16	854.3	350.0	1990.0
	pH	16	8.3	8.0	9.0
	Turbidity (NTU)	12	3.7	0.9	11.1
	Dissolved Oxygen (mg/L)	16	11.8	10.5	13.5
	Discharge[a] (m^3/s)	4	0.21	0.19	0.23

[a] See Appendix E for data pertaining to the St. Mary River and Lee Creek; discharge value from the Town of Milk River (WSC Station No. 11AA0005).

Historical discharge data was reviewed for three periods (August representing the summer sampling period, October representing the fall sampling period, and December representing critical overwintering periods; Figure 3.9). The mean monthly discharge for August 2000 was 13.8 m^3/s, which was similar to the historical mean discharge of 14.5 m^3/s. However, during October and December in both 2000 and 2001, discharge values were well below mean historical levels. The mean historical discharge for October was 2.7 m^3/s, whereas in 2000 and 2001, these values were 0.3 m^3/s and 0.2 m^3/s, respectively. In December, the mean historical discharge was 1.0 m^3/s, while in 2000 and 2001 discharges were 0.2 m^3/s and 0.06 m^3/s, respectively.

3.2.1.1 Habitat Conditions during Fall 2001

During fall 2001, aquatic habitat in the lower Milk River near the Pinhorn Ranch was extremely limited and of low quality. Due to the extreme drought conditions and early closure of the irrigation canal headgates, water levels became so low that only isolated pools were present in the lower Milk River near the Pinhorn Ranch area (Figure 3.10). It is quite likely that these conditions extended downstream toward the international border.

During field investigations, attempts were made to document the amount of water available in the isolated pools. Two sections of the river near the Pinhorn Ranch were selected for detailed sampling (Figure 3.10). The location (UTM's) and physical attributes of each isolated pool in these sections were recorded. Attributes included the length of the pool, average wetted width, average water depth, and average of the maximum water depths. The approximate wetted area and volume of (standing) water within this section of the Milk River was then calculated. This data was then compared to the area and volume of water (estimated) that was available during the summer (data collected in July).

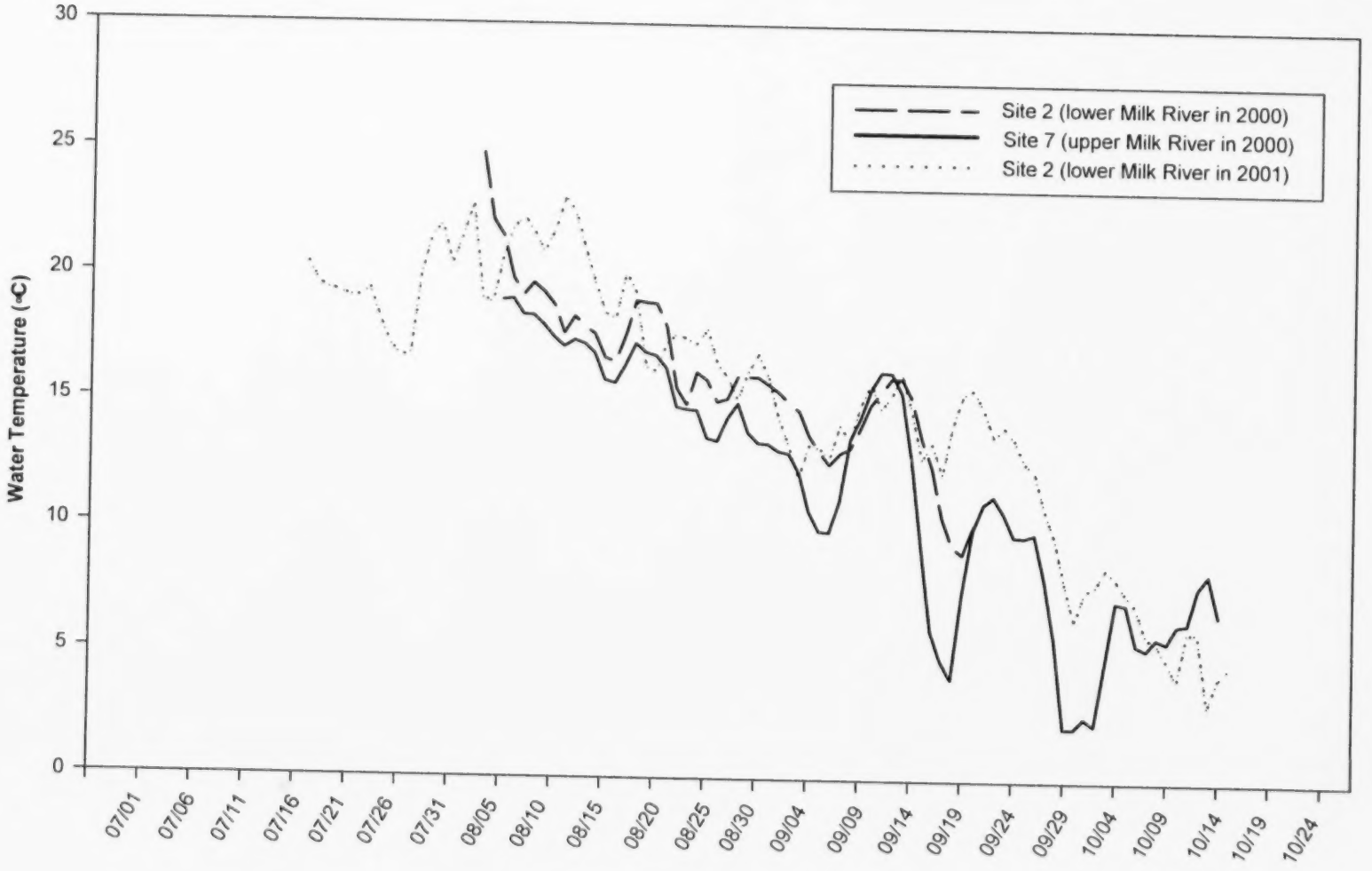

Figure 3.8 Mean daily water temperatures in the Milk River (summer and fall 2000-2001).

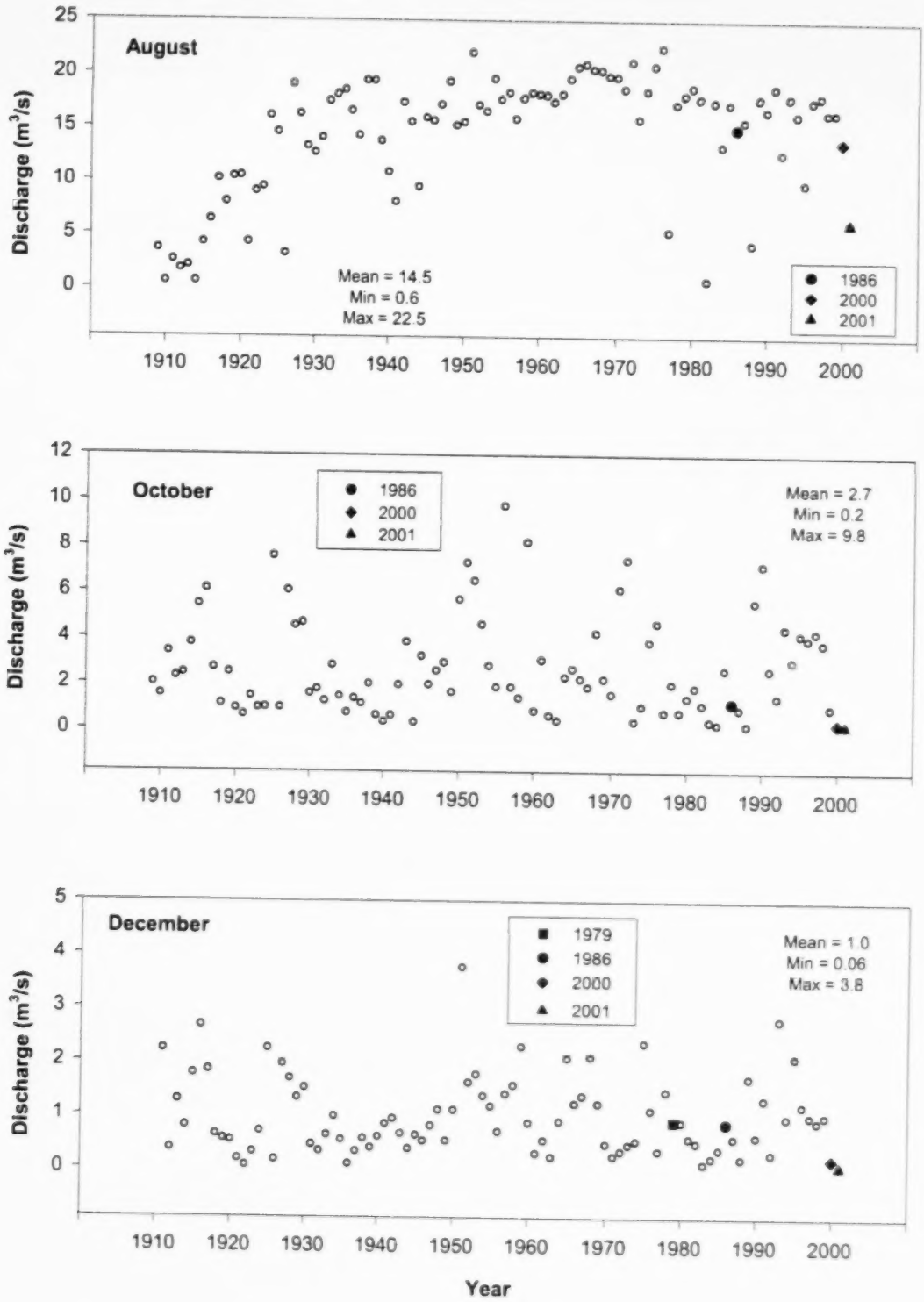

Figure 3.9 Seasonal discharge in the Milk River (1910 to 2001) at the Town of Milk River (closed symbols represent discharges in 1979, 1986, 2000 and 2001).

Section 2

Road to Ranch

Truck Trail

Pinhorn Ranch Headquarters

Milk River

Section 1

Flow

This area not sampled

Truck Ford

0 1 km

Figure 3.10
Isolated pools in the lower Milk River, October 2001.

Overall, 32 isolated pools were present in a 6.2 km section of the river near the Pinhorn Ranch. Pool lengths ranged from 28 to 354 m. The average pool length in Section 1 (downstream) was 115 m, while Section 2 (upstream) had an average pool length of 89 m (Table 3.15). The total length of all pools present was 3.8 km, whereas the total length of river sampled was 6.2 km; thus approximately 2.4 km of the river section sampled was completely dry.

The average wetted width for the two sections was 7.1 m. During the summer sampling session (July) wetted widths varied between 40 and 80 m. Average water depth was shallow, with a value of 0.24 m, while the maximum water depths recorded was 0.49 m in the sections sampled. The average water depth during fall was similar to summer; during summer the average was 0.28 m.

Large differences in total wetted area were documented between July and October (12-fold difference). The total wetted area over a 6.2 km section of river was 30 893 m^2 during October, whereas during July the total area of water over that section was approximately 379 088 m^2 (6.2 km multiplied by an average wetted width of 60.8 m).

Table 3.15 Surface area of isolated pools documented in the lower Milk River near the Pinhorn Ranch, October 2001.

River Section	River Length (m)	No. of Isolated Pools	Mean Length (m)	Mean Width (m)	Mean Water Depth (m)	Mean Max Depths (m)	Area of Isolated Pools (m^2)			
							Mean	Min	Max	Total Area
Section 1	4144	16	114.7	6.6	0.22	0.50	1125	104	4626	18 005
Section 2	2091	16	88.5	7.8	0.25	0.48	806	112	2304	12 888
Overall	**6235**	**32**	**102.7**	**7.1**	**0.24**	**0.49**	**965**	**104**	**4626**	**30 893**

3.2.1.2 Habitat Conditions during Late Winter 2002

Due to the extreme low flow conditions observed during the October 2001 sampling program, additional funding was sought to determine the degree and likelihood of overwintering success by fish in the lower Milk River. To this end, the Department of Fisheries and Oceans funded a late winter survey, which was conducted in March 2002. The results of this survey are presented in the report entitled "Species at Risk in the Milk River, Alberta – Late Winter Survey"; this report is provided in entirety in Appendix F.

Report Summary:
Ten isolated pools selected from a subset of pools investigated in October 2001 were sampled on 22 and 23 March 2002. Of those pools, two were frozen to the bottom (Sites 21 and 1), while two other pools (Sites 40 and 46) contained very little water (<0.09 m water depth). Mean water depths in pools that contained greater quantities of water was 0.15 m; the maximum depth in these pools was 0.34 m. It was apparent that isolated pools located near springs maintained higher water depths; pools which were not located near a spring were generally frozen to the bottom.

Dissolved oxygen levels in the pools were not found to be limiting. Values ranged from 10.2 to 18.6 mg/L (mean of 16.8 mg/L). Most values recorded were indicative of supersaturation, which probably reflected accelerated algae photosynthetic activity under the ice (i.e., low snow cover, extended photoperiod etc.). Not surprisingly, the dissolved oxygen level in the outflow from the spring was very low (2.6 mg/L).

Fish were encountered at only three of the ten sites (30%). Flathead chub (n=6) were documented at two sites and one longnose sucker was encountered at the third site. None of the species of interest were encountered in the March 2002 survey.

3.2.2 Habitat Use and Requirements

3.2.2.1 St. Mary sculpin

Habitat Types

2000

In 2000, St. Mary sculpin were captured predominantly in riffles (48% of sculpins were captured in this habitat type) and shallow runs (32%; Table 3.16). However, differences in habitat types between the three drainages were evident. In the Milk River, sculpins utilized a diverse range of habitat types, including shallow runs (R3; 39%), riffle (27%), and riffle/boulder gardens (16%). Backwaters, shallow flats, and pool habitat types were also selected to a lesser extent. In the St. Mary River and Lee Creek, sculpin were associated with both riffles and shallow runs, but riffles were by far the dominant habitat type (>74% occurrence).

Unfortunately, the habitat where species of interest were absent was not quantified. However, upon reviewing the report conducted in 1986 by RL&L (1987), data collected during that study is quite reflective of the aquatic habitat encountered during the present study. Percent length of habitat types is summarized by river section (i.e., lower, mid and upper) in Table 3.17 and by habitat unit in Figures 3.11 and 3.12. Results from this study indicated that flat and shallow run habitat was more prevalent in the downstream sections of the Milk River (Habitat Units #1-3). In the mid-section (Habitat Units #4-6), shallow runs were most common. In the upper section of the Milk River (Habitat Units #7-10), runs, riffles, and rapids were the dominant habitat types. Results from Section 3.1.3.2 (Relative Abundance by Site) indicated that most sculpin were encountered in the mid to upper reaches of the Milk River.

2001

In 2001, St. Mary sculpin were captured predominantly in shallow runs (62% occurrence in areas where sculpin were captured) and riffles (20%; Table 3.18). As was the case in 2000, St. Mary sculpin in the Milk River utilized a diverse range of habitat types. Most individuals were associated with shallow runs (R3; 54%), followed by riffle (21%), and run/boulder gardens (13%). Snyes, shallow flats, and riffle/boulder garden habitat types were also utilized. In the St. Mary River and Lee Creek, sculpins were associated with both riffles and shallow runs, but shallow runs were by far the dominant habitat type (>70% occurrence).

Table 3.16 Percent occurrence of habitat types[a] in areas where St. Mary sculpin were captured in the Milk and St. Mary drainages, 2000.

Habitat Type	Milk River		St. Mary River		Lee Creek		Overall	
	No.	Percent Occurrence	No.	Percent Occurrence	No.	Percent Occurrence	No.	Percent Occurrence
Backwater	7	7.6					7	4.6
Flat (F3)	4	4.3					4	2.6
Pool (P3)	1	1.1					1	0.7
Run (R2)	2	2.2					2	1.3
Run (R3)	36	39.1	11	25.6	1	6.3	48	31.8
Run/Boulder garden	2	2.2					2	1.3
Riffle	25	27.2	32	74.4	15	93.8	72	47.7
Riffle/Boulder garden	15	16.3					15	9.9
Total	**92**	**100.0**	**43**	**100.0**	**16**	**100.0**	**151**	**100**

[a] See Appendix B for definitions.

Table 3.17 Summary of percent length of habitat types[a] documented in the Milk River, 1986 (RL&L 1987).

River Section	Habitat Unit	Riffle	Rapid	Run (R1)	Run (R2)	Run (R3)	Flat	Pool	Total
Lower	1-3	4.6	0.0	0.0	10.3	24.3	59.8	1.0	100.0
Mid	4-6	25.0	7.6	6.6	15.5	38.3	5.2	1.7	100.0
Upper	7-10	26.6	17.1	1.0	23.0	30.5	0.7	1.2	100.0

[a] See Appendix B for definitions.

Table 3.18 Percent occurrence of habitat types[a] in areas where St. Mary sculpin were captured in the Milk and St. Mary drainages, 2001.

Habitat Type	Milk River		St. Mary River		Lee Creek		Overall	
	No.	Percent Occurrence	No.	Percent Occurrence	No.	Percent Occurrence	No.	Percent Occurrence
Backwater			2	10.0			2	2.2
Flat (F3)	3	4.9					3	3.3
Run (R3)	33	54.1	16	80.0	7	70.0	56	61.5
Run/Boulder garden	8	13.1					8	8.8
Riffle	13	21.3	2	10.0	3	30.0	18	19.8
Riffle/Boulder garden	3	4.9					3	3.3
Snye	1	1.6					1	1.1
Total	**61**	**100.0**	**20**	**100.0**	**10**	**100.0**	**91**	**100.0**

[a] See Appendix B for definitions.

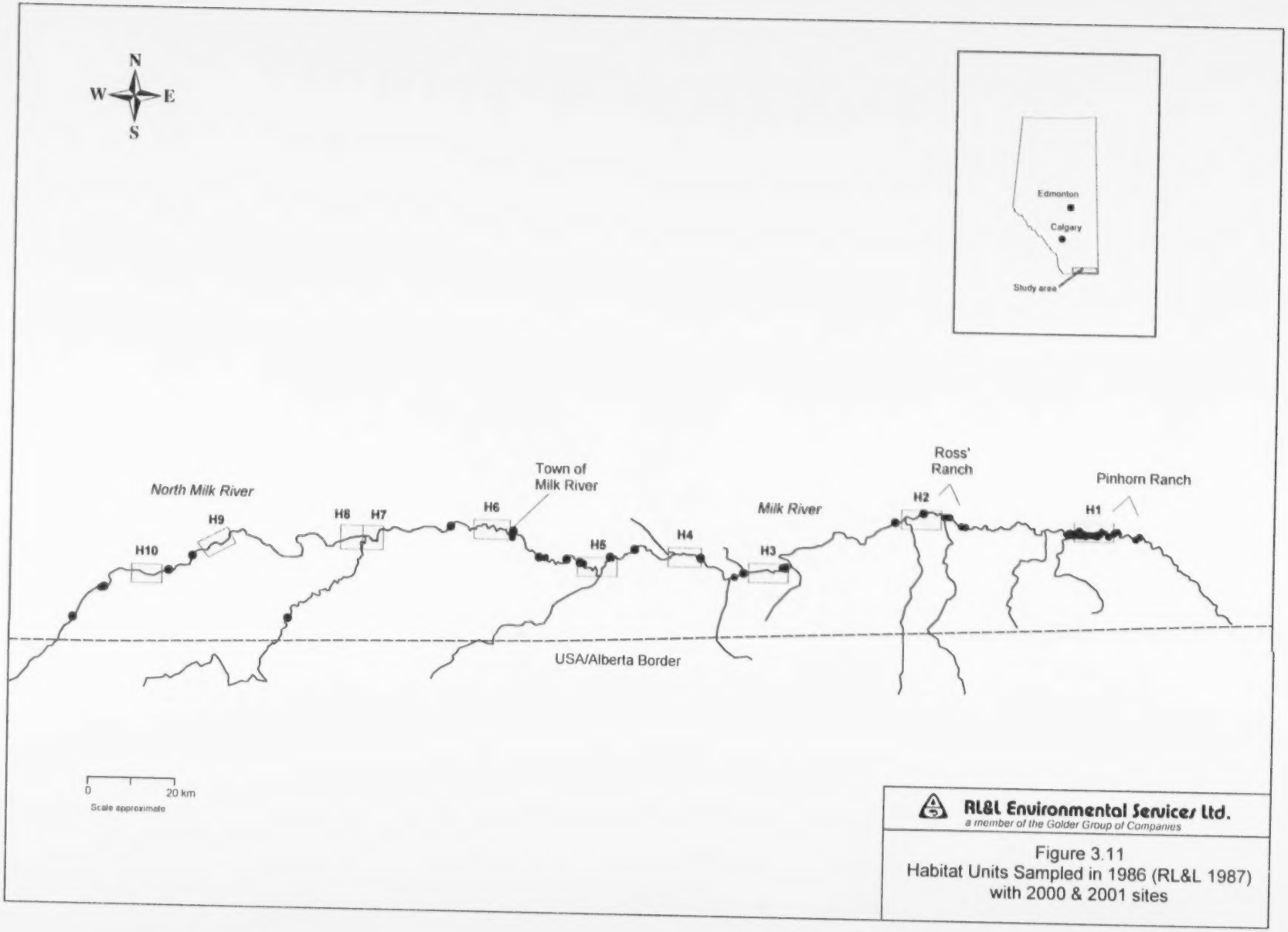

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Figure 3.11
Habitat Units Sampled in 1986 (RL&L 1987)
with 2000 & 2001 sites

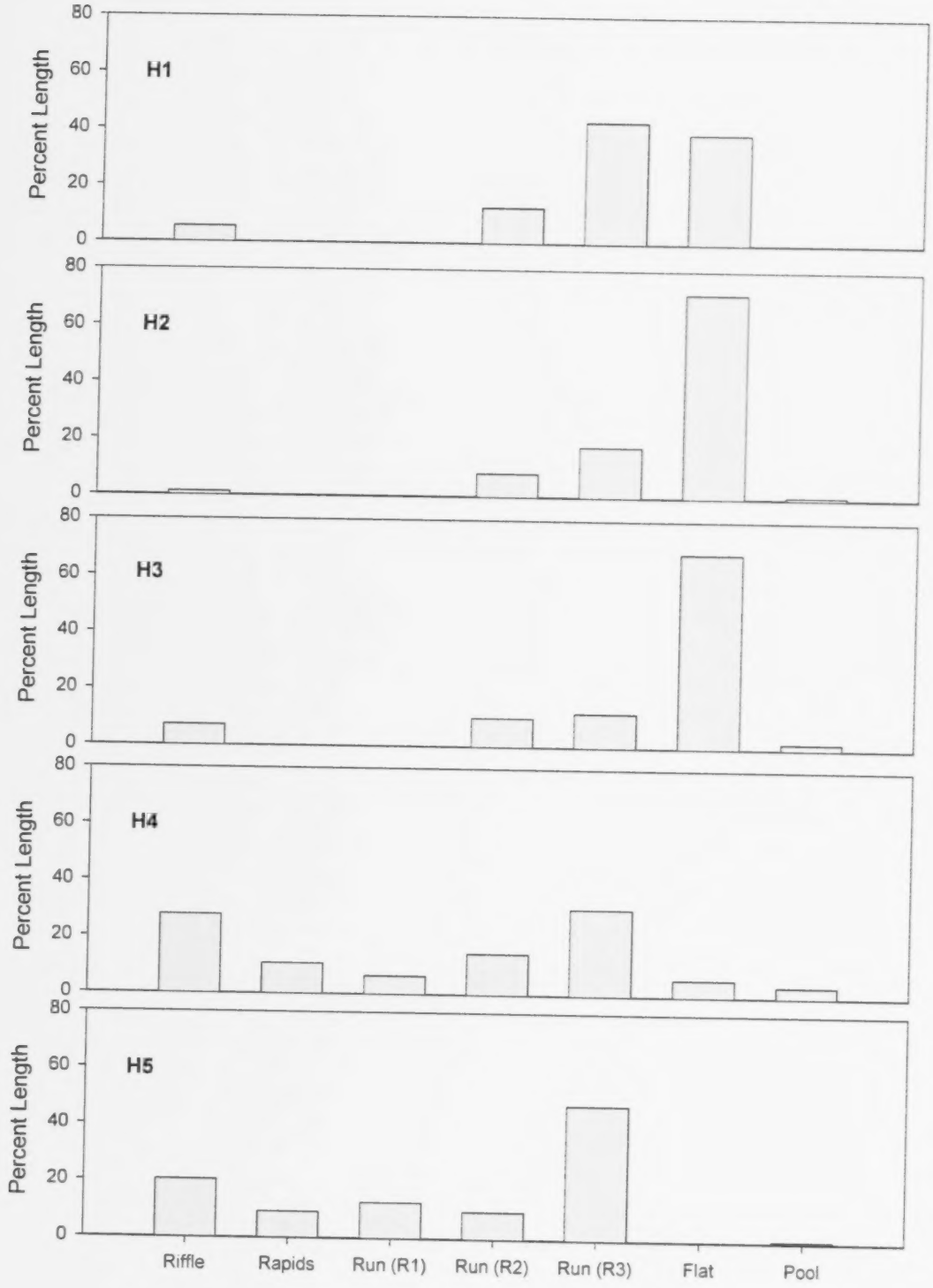


Figure 3.12 Percent length of habitat types documented in the Milk River, 1986 (RL&L 1987).

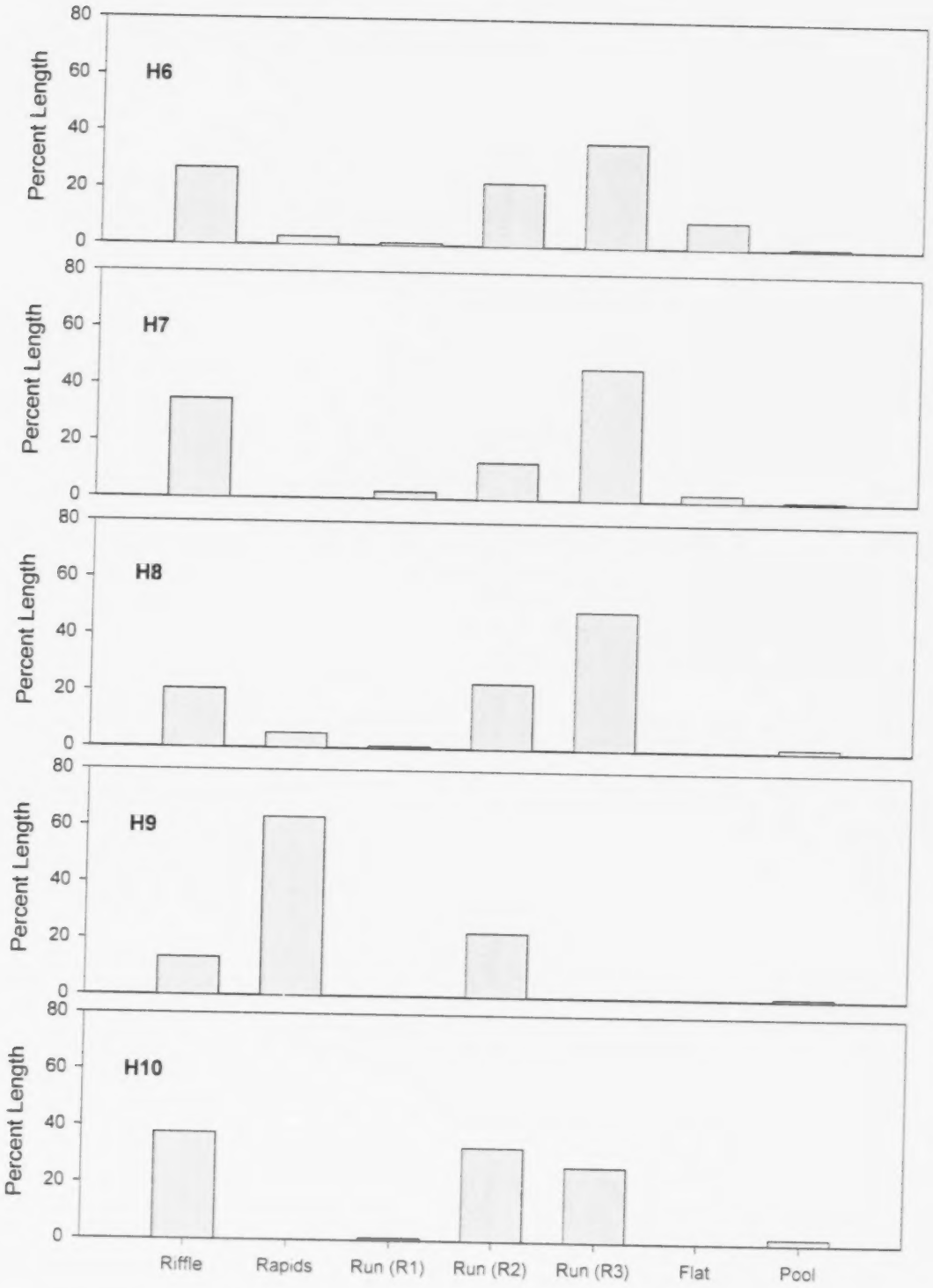


Figure 3.12 Continued

Habitat Variables

A One-way Analysis of Variance (ANOVA) was also used to determine statistical differences in the means of habitat variables between sites. This was performed to determine if each of the species of interest consistently utilized similar ranges in habitat variables (i.e., not significant results) throughout the river systems or to determine if they utilized a range in habitat variables (i.e., significant results). Habitat variables analysed included depth and velocity at capture, maximum water depth and velocity, D90, silt depth, percent rock as cover and depth/turbidity as cover, and percent gravel and cobble as substrate. Each of the habitat variables analysed resulted in significant differences ($P<0.05$), with the exception of silt depth ($P>0.05$; Appendix E). These results indicate that St. Mary sculpin are not associated with a specific type of habitat or specific range in habitat values, but rather are more generalists in the types of habitat that they utilize. The means of the habitat variables analysed and the standard errors were plotted for visual illustration of the range in habitat variables between sites (Figure 3.13).

Water depth at the capture location was generally shallow; most values ranged from 0.05 to 0.42 m (mean of 0.19 m; Figure 3.13). Water velocities at the location of capture ranged from 0.00 to 0.60 m/s, with a mean velocity of 0.22 m/s. Maximum velocities across the river channel ranged from 0.00 to 1.19 m/s, with a mean velocity of 0.38 m/s. D90 ranged from 0.00 to 0.32 m (mean of 0.17 m). Silt depth was generally low (0 to 0.02 m depths); the highest silt depth recorded was 0.04 m. For percent rock cover, most values ranged from 10 to 40%. The percentage of turbidity as cover was low, with most values ranging from 0 to 5% (Figure 3.13). Mean substrate size generally ranged from 2 to 22 cm (RL&L 2000). The percentage of gravel and cobble as substrate was quite variable. For cobble substrate, most values ranged between 15 and 56%, and gravel substrate ranged between 21 and 55%.

Overall, the data suggests that St. Mary sculpin generally use riffle and shallow run habitats, in low to moderate velocities and low silt depths. Substrate size consisted primarily of gravel and cobble. The distance of a captured fish from cover was also measured during sampling; most sculpins were closely associated with cover (i.e., distance from cover was approaching 0 m), and rock was the predominant type of cover.

3.2.2.2 Stonecat

Habitat Types

Overall, stonecat were encountered predominantly in shallow runs (40% occurrence in areas where stonecat were captured) and flat habitat types (20%; Table 3.19). There were slight differences in habitat types between years. In 2000, stonecat were also encountered in run and riffle boulder garden habitat types, whereas in 2001, stonecat were also encountered in isolated pools in the lower Milk River. Isolated pools could not be considered a preferred habitat since these fish had no other option (i.e., could not emigrate).

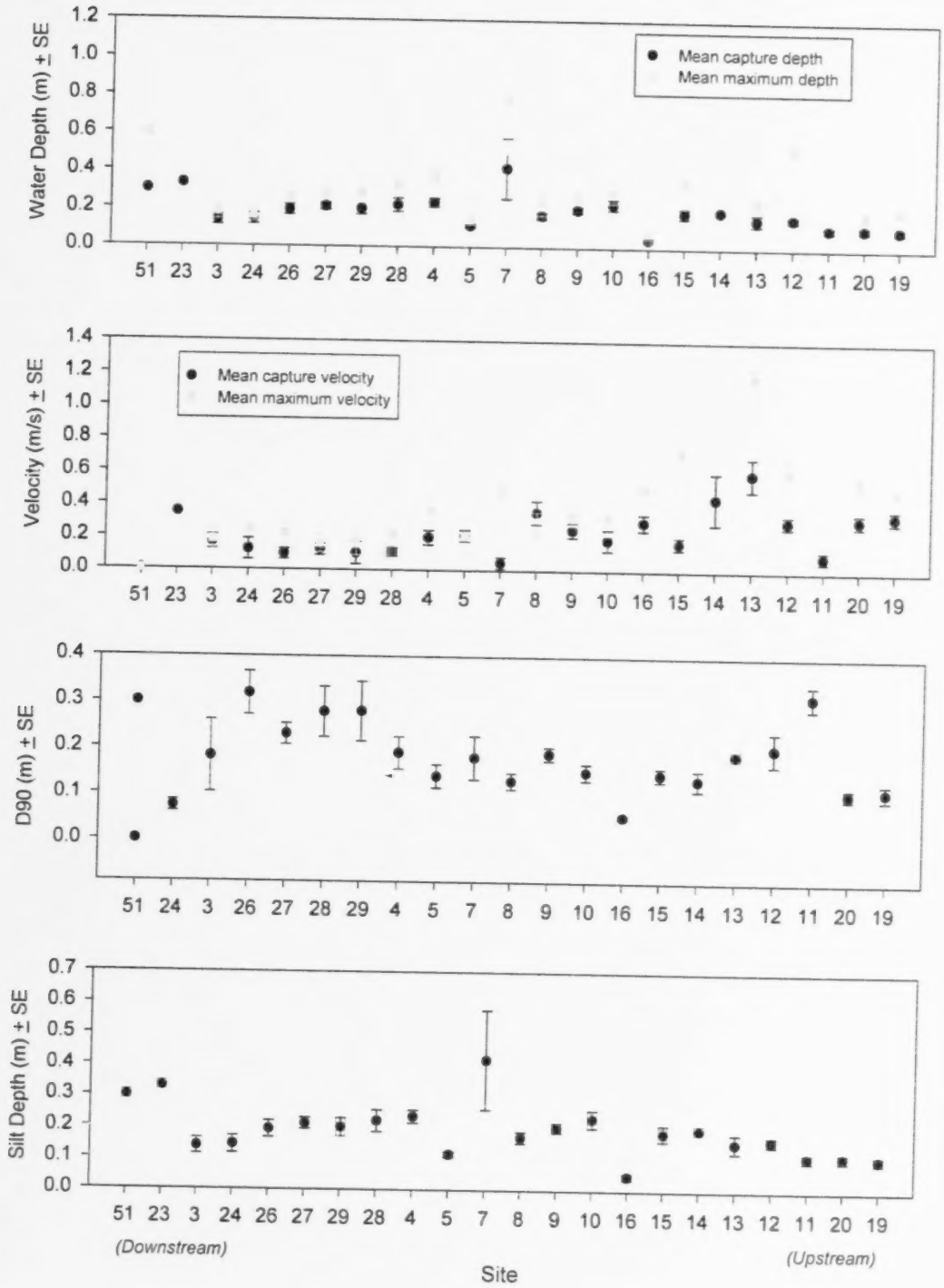

Water Depth (m) ± SE
Mean capture depth
Mean maximum depth
Velocity (m/s) ± SE
Mean capture velocity
Mean maximum velocity
D90 (m) ± SE
Silt Depth (m) ± SE
51 23 3 24 26 27 29 28 4 5 7 8 9 10 16 15 14 13 12 11 20 19
51 24 3 26 27 28 29 4 5 7 8 9 10 16 15 14 13 12 11 20 19
(Downstream)
(Upstream)
Site

Figure 3.13 Microhabitat characteristics (means of habitat variables by site) at St. Mary sculpin capture sites in the Milk and St. Mary drainages, 2000-2001.

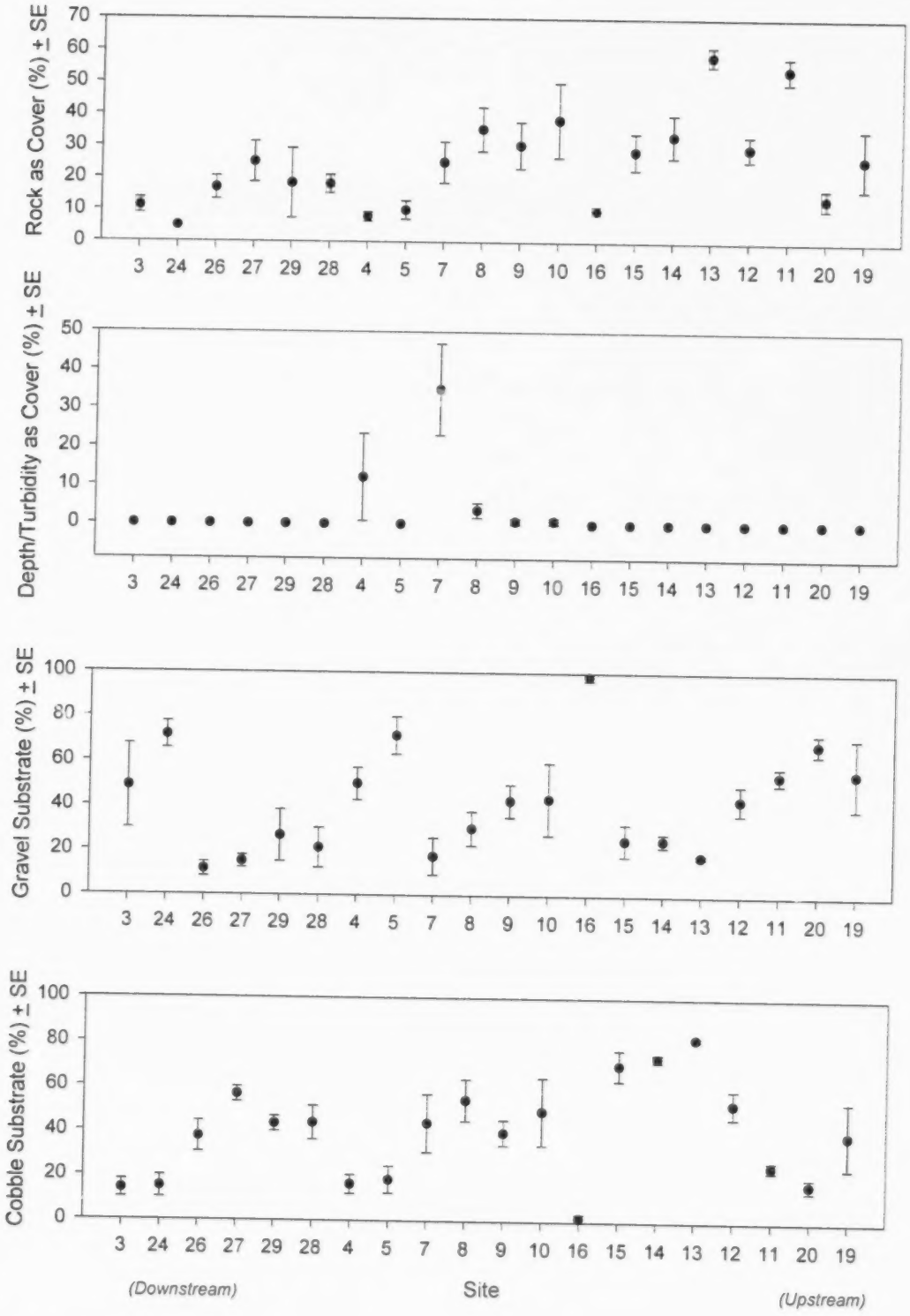


Figure 3.13 Concluded

Table 3.19 Percent occurrence of habitat types[a] in areas where stonecat were captured in the Milk River, 2000-2001.

Habitat Type	2000		2001		Overall	
	No.	Percent Occurrence	No.	Percent Occurrence	No.	Percent Occurrence
Flat (F2)			1	9.1	1	3.3
Flat (F3)	4	21.1	1	9.1	5	16.7
Run (R2)			4	36.4	4	13.3
Run (R3)	6	31.6	2	18.2	8	26.7
Run/Boulder garden	5	26.3			5	16.7
Riffle/Boulder garden	4	21.1			4	13.3
Isolated pool			3	27.2	3	10.0
Total	**19**	**100.0**	**11**	**100.0**	**30**	**100.0**

[a] See Appendix B for definitions.

Habitat Variables

A One-way Analysis of Variance (ANOVA) was performed to determine if there were significant differences within the habitat variables measured at stonecat capture locations. Habitat variables analysed included depth and velocity at capture, maximum water depth and velocity, D90, silt depth, percent rock as cover, and percent boulder as substrate. Habitat variables, which resulted in significant differences included silt depth, maximum water velocity, percent as rock cover and percent boulder as substrate ($P<0.05$; Appendix E). Variables that were not significantly different included depth and velocity at capture, D90, and maximum water depth ($P>0.05$; Appendix E). The means of the habitat variables analysed and the standard errors were plotted for visual illustration of the range in habitat variables between sites (Figure 3.14).

Water depths at capture ranged from 0.25 to 0.66 m (mean of 0.35), while maximum water depths ranged from 0.33 to 0.67 m. Water velocity at capture ranged from 0.0 to 0.19 m/s (mean of 0.08 m/s), while maximum water velocity ranged from 0 to 0.29 m/s. D90 had a mean of 0.51 m (minimum of 0.35 and maximum of 0.84 m). Silt depth was generally low (0 to 0.10 m depths). Mean substrate size was represented by large substrate (21 to 57 cm; RL&L 2001). Percent boulder as substrate ranged from 5 to 80% (mean of 36%). Percent area of rock as cover ranged from 5 to 53%, with a mean of 20%. The distance of a captured fish from cover was also measured during sampling; all stonecats were closely associated with cover (i.e., distance from cover was approaching 0 m), and cobble/boulder was the predominant type of cover.

Overall, the data suggests that stonecat generally use run and flat habitat types, in low to moderate velocities and low silt depths. Substrate size consisted of a mixture of small and large substrate, but all stonecats were found residing between and/or under cobble and boulder substrate.

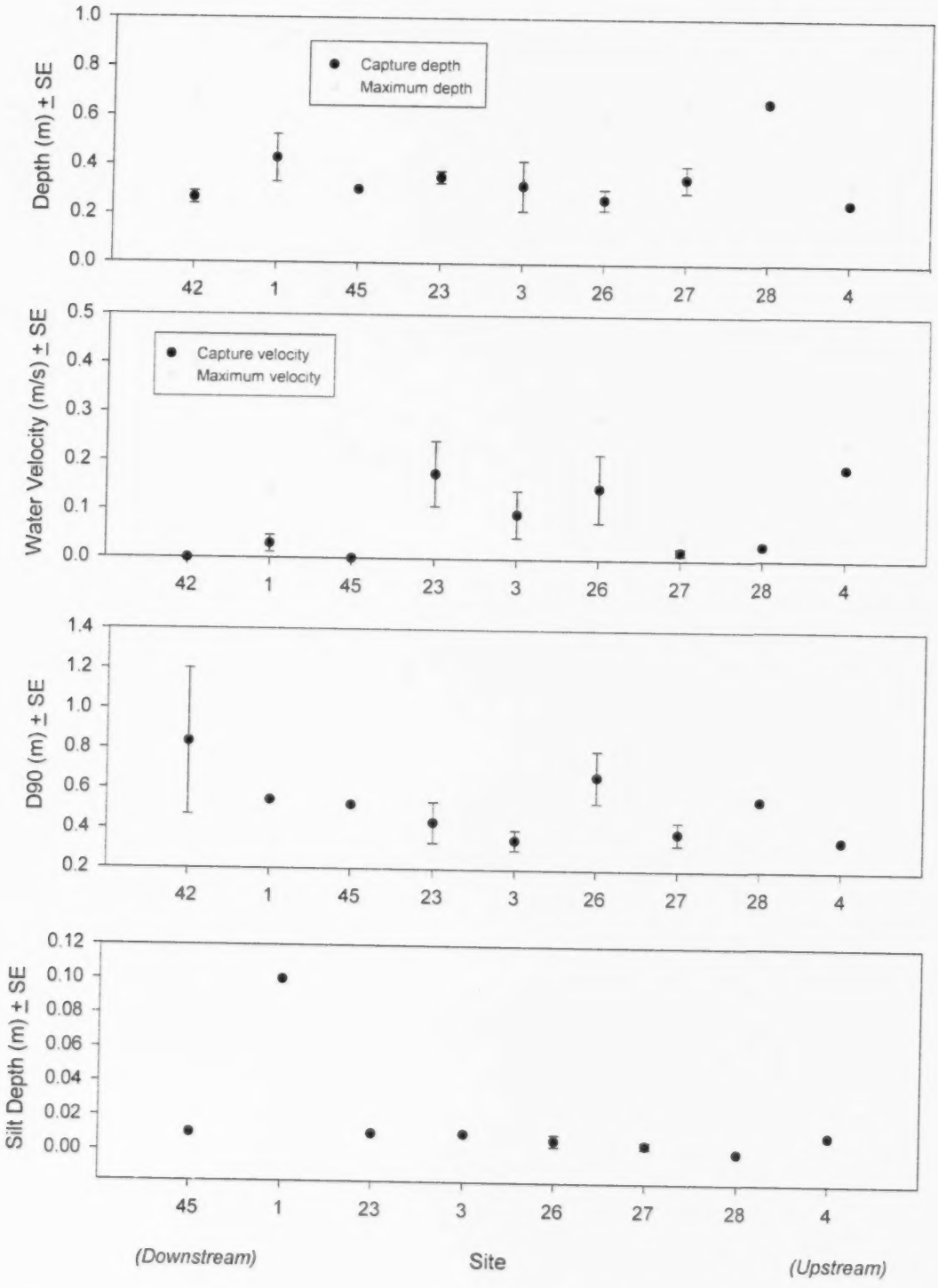


Figure 3.14 Means of habitat variables for stonecat in the Milk River, 2000-2001.

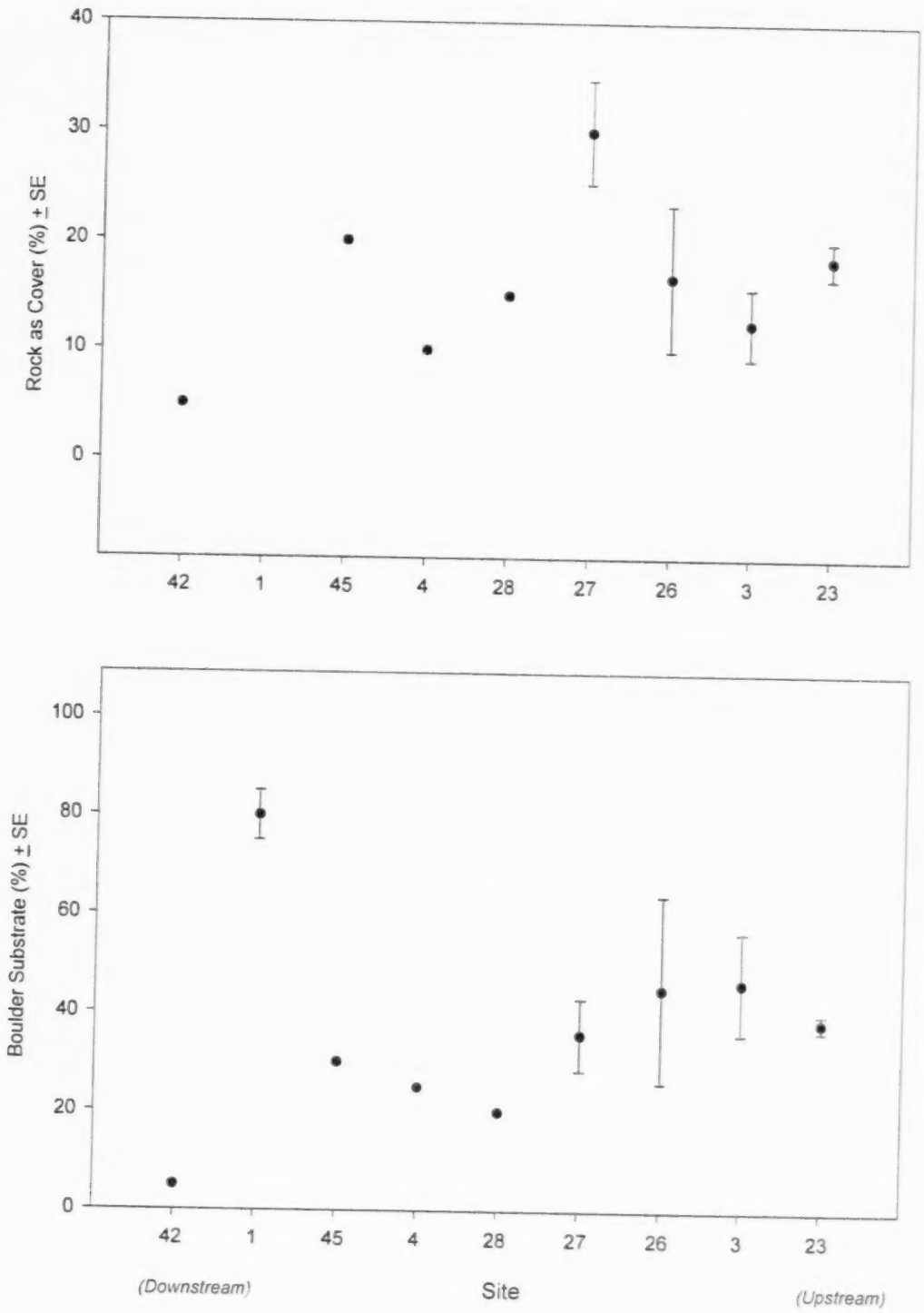


Figure 3.14 Concluded.

3.2.2.3 Western Silvery Minnow

Habitat Variables

A One-way Analysis of Variance (ANOVA) was performed to determine if there were significant differences within the habitat variables measured at western silvery minnow capture locations. Habitat variables analysed included depth and velocity at capture, maximum water depth and velocity, D90, silt depth, percent depth/turbidity as cover, and percent sand as substrate. Habitat variables that resulted in significant differences included water depth at capture, D90, and maximum water depth (Appendix E). Variables that were not significantly different included water velocity at capture, maximum water velocity, silt depth, percent depth/turbidity as cover, and percent sand as substrate.

Water depths at capture ranged from 0.24 to 0.69 m (mean of 0.42 m) for western silvery minnow. Maximum water depths ranged from 0.28 to 0.81 m. Water velocity at capture ranged from 0.0 to 0.03 m/s, while maximum water velocity ranged from 0 to 0.04 m/s. The mean value of D90 was 0.02 m. Silt depth was generally low (0 to 0.10 m depths). Percent sand as substrate ranged from 95 to 100% (mean of 98%). Cover was provided by turbidity (5-10%).

3.2.2.4 Brassy Minnow

In the present study, too few brassy minnows were captured to perform statistical analyses on habitat variables. However, descriptions of the habitat variables can be made. In 2000, brassy minnow were present in two very different habitat types in the Milk River. At Site 4 (mid-river), one brassy minnow was captured in fast flowing, riffle habitat. Water depths were 0.12 m and velocities were 0.6 m/s. The substrate consisted predominantly of gravel (>85% composition), with low silt deposition (<0.01 m). D90 was 0.05 m. The river was quite turbid (10.3 NTU) at the time of sampling, with water transparencies of 0.15 m. The other eight brassy minnows were captured in a deep, backwater area in the lower Milk River (Site 22). Maximum depth in the backwater was 1.1 m and velocity was negligible (<0.01 m/s). Substrate consisted predominantly of sand (>90% composition) and some silt (silt depth of 0.01 m). Cover types included depth and turbidity (15% area) and large woody debris (10%). Similarly, the only brassy minnow captured in 2001, was captured in a snye downstream of Ross' Ranch (Site 50). Water depth at the capture location was 0.24 m, while no velocity was evident (<0.01 m/s). Sand was the dominant substrate (95%), with some silt (5%).

3.2.2.5 Sauger

Habitat Types

In general, sauger were encountered in moderately shallow run (R3) and flat (F2 and F3) habitat types (Table 3.20). In 2001, most fish were captured in isolated pools, however this could not be considered a preferred habitat since these fish had no other option.

Table 3.20 Percent occurrence of habitat types[a] in areas where sauger were captured in the Milk River, 2000-2001.

Habitat Type	2000		2001		Overall	
	No.	Percent Occurrence	No.	Percent Occurrence	No.	Percent Occurrence
Flat (F2)	3	60.0			3	5.0
Flat (F3)			1	1.8	1	1.7
Run (R3)	2	40.0			2	3.3
Isolated pool			54	98.2	54	90.0
Total	**5**	**100.0**	**55**	**100.0**	**60**	**100.0**

[a] See Appendix B for definitions.

Habitat Variables

A One-way Analysis of Variance (ANOVA) was performed to determine if significant differences existed for the various habitat variables. Habitat variables analysed included depth and velocity at capture, maximum water depth and velocity, D90, silt depth, and percent sand as substrate. Each of the habitat variables analysed resulted significant differences ($P<0.05$), with the exception of water velocity at capture and maximum velocity ($P>0.05$; Appendix E). The means of the habitat variables analysed and the standard errors were plotted for visual illustration of the range in habitat variables between sites (Figure 3.15).

Water depth at the capture location was moderately shallow; most values ranged from 0.21 to 0.75 m (mean of 0.43 m; Figure 3.15). Water velocities at the location of capture ranged from 0 to 0.03 m/s. Maximum water depths across the river channel ranged from 0.06 to 0.86 m. Maximum velocities ranged from 0 to 0.06 m/s. D90 ranged from 0.00 to 0.83 m (mean of 0.36 m). Silt depth was generally low (0 to 0.10 m depths). The percentage of sand as substrate ranged from 45 to 100% (mean of 81%). Cover was represented primarily by depth and turbidity, where values ranged from 0 to 100% (mean of 40%).

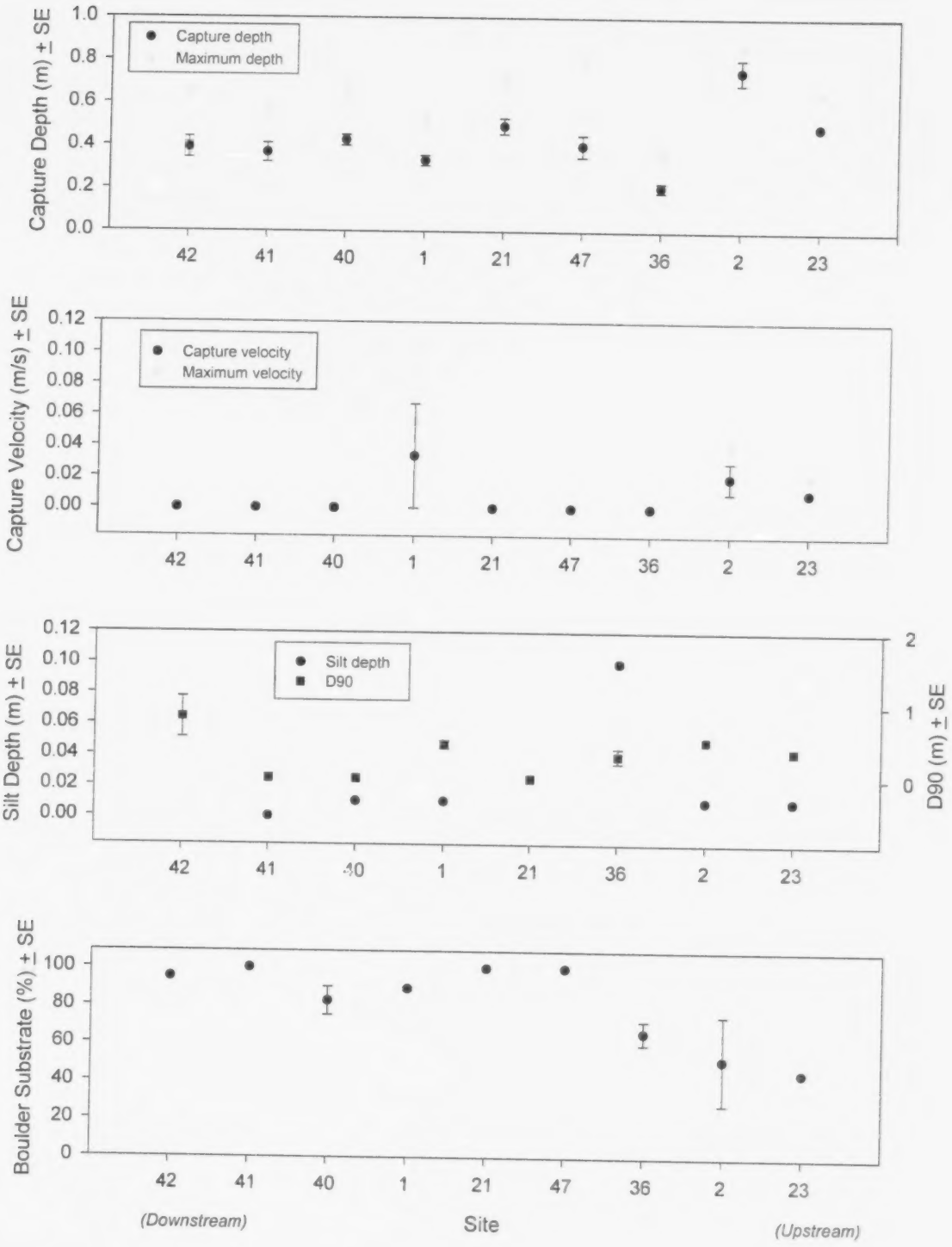


Figure 3.15 Means of habitat variables by site for sauger in the Milk River, 2000-2001.

4.0 DISCUSSION

4.1 Fish

4.1.1 Species Composition

Overall, 16 fish species were encountered in the Milk and St. Mary drainages during the present study. The Milk River had the most diverse range of fish species present, with a total of 14 species. Seven species were recorded in each of the St. Mary River and Lee Creek. Of the five species of interest, all were encountered in the Milk River. Only the St. Mary sculpin was recorded in the St. Mary River and Lee Creek. This was expected since the St. Mary River drainage is located outside the geographical range for the other species of interest.

In both years of study (2000 and 2001), flathead chub dominated the catch in the Milk River, followed by sucker species, and longnose dace. During 2000 in the St. Mary River, longnose dace dominated the catch followed by St. Mary sculpin. Since the St. Mary River was not sampled during summer 2001, comparisons between years could not be made. However, when comparing fall of both years, species composition was similar (dominated by St. Mary sculpin, followed by sucker species and longnose dace). In Lee Creek, longnose dace were numerically dominant in both years, followed by St. Mary sculpin and sucker species.

Species composition varied seasonally in the Milk and St. Mary rivers in 2000, however this was not the case in 2001 (sampled only the lower Milk River in summer 2001). In the Milk River during summer 2000, longnose dace and sucker species dominated, while during fall, flathead chub dominated, followed by sucker species, longnose dace, and St. Mary sculpin. In 2001, results for both summer and fall were similar to those recorded in fall 2000, with the exception of St. Mary sculpin.

In 2000, St. Mary sculpin represented a greater proportion of the catch during the fall than during summer in both the Milk and St. Mary rivers. Brassy minnow and sauger represented similar percentages in composition during both summer and fall, while stonecat and western silvery minnow were captured only during fall sampling. These species of interest represented low numbers of the catch (<2%) during all seasons sampled.

Species composition in the present study (2000-2001) was similar to that recorded in 1969 and 1986 (Table 4.1). In general, sucker species, longnose dace, and flathead chub dominated the catch in each of the study years. With respect to the study species, percent contribution to the catch between years was relatively similar. St. Mary sculpin was the only species that varied in the catch between years. In 1969, St. Mary sculpin contributed 1.1% to the catch and in 1986 they contributed 4.8%. In 2000, sculpins represented 9.7%, while they represented 1.5% in 2001. All other species of interest represented <1.5% of the overall composition (i.e., in 1969, 1986, 2000, and 2001).

The results of the Clayton and Ash (1980) investigations differed from those obtained in other studies (1969, 1986, and 2000-2001), likely because it was conducted during late November and February. The other studies were conducted during open water periods (primarily summer

and fall). Clayton and Ash (1980) reported that St. Mary sculpin was the dominant species (43.7%) during late fall and winter, followed by longnose dace (36.1%). Stonecat also made a larger contribution to the catch (5.9%) relative to other study years.

A study currently being conducted in the Milk River from the international border to the Fresno Reservoir in Montana, documented ten fish species (pers. com. Sean Stash, Montana State University). Flathead chub were by far the most dominant species (85.9% by composition), followed by western silvery minnow (5.8%). Sauger represented 2.5% of the composition and stonecat represented 1.3%.

Table 4.1 Numbers and percent composition of fish species encountered in the mainstem Milk River during 1969, 1979-80, and 1986.

Species	Willock (1969)		Clayton and Ash (1980)		RL&L (1987)	
	No.	Percent	No.	Percent	No.	Percent
Brassy minnow					12	0.1
Sauger	15	0.1			76	0.4
St. Mary sculpin	155	1.1	214	43.7	1009	4.8
Stonecat	35	0.2	29	5.9	3	<0.1
Western silvery minnow	3	<0.1	2	0.4	10	<0.1
Brook stickleback	142	1			22	0.1
Burbot	1	<0.1	4	0.8	1	<0.1
Fathead minnow	935	6.5			64	0.3
Flathead chub	1337	9.2	1	0.2	1502	7.1
Lake chub	1129	7.8	5	1	945	4.5
Longnose dace	2749	19	177	36.1	4241	20.2
Mountain whitefish	22	0.2			137	0.7
Northern pike	40	0.3			32	0.2
Longnose sucker	2983	20.6	3	0.6	4770	22.7
Mountain sucker	1257	8.7	53	10.8	4089	19.4
Sucker spp.					2575	12.2
White sucker	3660	25.3	2	0.4	1537	7.3
Total	**14 463**	**100**	**490**	**100**	**21 025**	**100**

4.1.2 Fish Distribution

The Milk River basin is unique in Alberta since it is the only river in the Province that contributes to the Missouri River drainage. As a result, one member of the provincial fish species assemblage (i.e., stonecat) occurs only in the Milk River. The Milk River also contains species that are restricted in distribution in Alberta, such as the western silvery minnow, St. Mary sculpin, and brassy minnow (RL&L 1987).

St. Mary sculpin

St. Mary sculpin (*Cottus* spp.) occurs in southern British Columbia (primarily in the Columbia River drainage) and in southern Alberta. In Alberta, St. Mary sculpin are known only from the St. Mary and Milk river drainages (Roberts 1988; Nelson and Paetz 1992; Paetz 1993). This species likely entered into the Milk River from the St. Mary River through irrigation canals in Montana (Nelson and Paetz 1992).

In the Milk River, St. Mary sculpin were widely distributed in the mainstem, but they were absent from the catch in the lowermost section (Figure 4.1). The results from the present study (2000-2001) were consistent with those documented in 1986 by RL&L (1987) and other studies, with the exception of the upper Milk River (above its confluence with the North Milk River). St. Mary sculpin have been documented in the upper Milk River in previous years (Paetz 1993); during the present study, this section of river was dry.

St. Mary sculpin were present throughout the entire study section of the St. Mary River (above the reservoir) in 2000 (only index sites sampled in 2001). However, in Lee Creek, St. Mary sculpin were documented only in the lower sections (upper distribution was approximately 6 km upstream of Cardston).

Stonecat

In Canada, the stonecat occurs in the St. Lawrence River and tributaries, the Great Lakes area, southern Manitoba, and southern Alberta. Within Alberta, stonecats have been recorded only in the Milk River. In the present study, stonecats were captured primarily in the mid-sections of the Milk River and at several sites in the lower section (Figure 4.2). However, Willock (1969) documented a much broader range (i.e., confluence with the North Milk River downstream to the international border).

Western Silvery Minnow

In Canada, the western silvery minnow occurs only in southern Alberta. Its range is restricted to the Milk River, and possibly the South Saskatchewan River (RL&L 1987). This species appears to have a limited distribution within the Milk River, based on the 2000-2001 and 1986 studies by RL&L (Figure 4.3). In these two studies, the silvery minnow was documented only in the lower Milk River. The farthest upstream capture site was located downstream of the town of Milk River (*In:* Nelson and Paetz 1992). Other authors that have documented the western silvery minnow in the Milk River include: Willock (1969) and Clayton and Ash (1980). Willock (1969) reported a substantial population of silvery minnows (n=368) in the Lost River (a tributary to the Milk River); however, during the present study, the Lost River at the Highway 502 bridge crossing was dry. Willock (1969) also noted that the Lost River is a small, intermittent stream, and thus not always available as habitat to the western silvery minnow.

One specimen of western silvery minnow has previously been recorded in the South Saskatchewan River by Henderson and Peter (1969); however, the identification of this specimen has been questioned. Nelson and Paetz (1992) noted that the specimen should be obtained for species verification. Willock (1969) suggested that this specimen might have been captured for bait and released in the South Saskatchewan River.

Brassy Minnow
In Canada, the brassy minnow occurs in the St. Lawrence River-Great Lakes area, southern Manitoba, Saskatchewan, Alberta, and isolated parts of British Columbia. In Alberta, the brassy minnow has been recorded only in the Milk River basin, Musreau Lake (Peace River drainage), and the Athabasca River near Fort McMurray (RL&L 1987). The distribution of brassy minnow appeared to be limited to the mid-section of the Milk River, from the Town of Milk River downstream to the Aden Bridge (RL&L 2001 and 1987; Figure 4.4). However, Nelson and Paetz (1992) recorded this species in the lower Milk River near the international border. Willock (1969) captured brassy minnow in a number of tributaries draining from the Sweetgrass and Cypress Hills area (including Breed, Black and Police Coulees); but this species was not documented in Deer and Van Cleeve Coulees. During the 2000-2001 studies, most tributaries were dry due to extreme drought conditions in the area.

Sauger
In Canada, sauger occurs in the St. Lawrence River-Great Lakes area, and in southern Manitoba, Saskatchewan, and Alberta. Within Alberta, this species occurs in the North Saskatchewan, Red Deer, Bow, Oldman, St. Mary, South Saskatchewan, and Milk rivers (Nelson and Paetz 1992). In the Milk River, sauger have been recorded from the confluence with the North Milk River, downstream to the international border (Figure 4.5; Willock 1969; RL&L 1987).

4.1.3 Relative Fish Abundance

Relative Abundance by Drainage

Backpack Electrofishing

The overall catch-per-unit-effort (CPUE) within the two study drainages varied between years. In 2000, the overall CPUE during the fall was 6.1 fish/min in the Milk River, while during fall 2001 the CPUE was considerably higher (10.7 fish/min). In the St. Mary River, the overall CPUE during the fall was 4.2 fish/min in 2000, compared to 7.9 fish/min in fall 2001. All species of interest in the Milk River during fall of both years exhibited CPUE's <0.8 fish/min, with the exception of St. Mary sculpin during 2000 (1.8 fish/min).

The 2000 backpack electrofishing results indicated that the relative abundance of most species varied seasonally (note: backpack electrofishing was not conducted during summer in 2001). In the Milk River during summer, St. Mary sculpin had the highest relative abundance followed by longnose dace, while during fall, the opposite was true (longnose dace then St. Mary sculpin). In contrast, in the St. Mary River during summer, longnose dace exhibited the highest relative abundance, followed by St. Mary sculpin; again the opposite was true during fall (St. Mary sculpin then longnose dace). Lee Creek was sampled only during summer, where longnose dace were by far the most abundant species. In general, the relative abundance of most fish species in the Milk River was higher during fall than summer during both years of study.

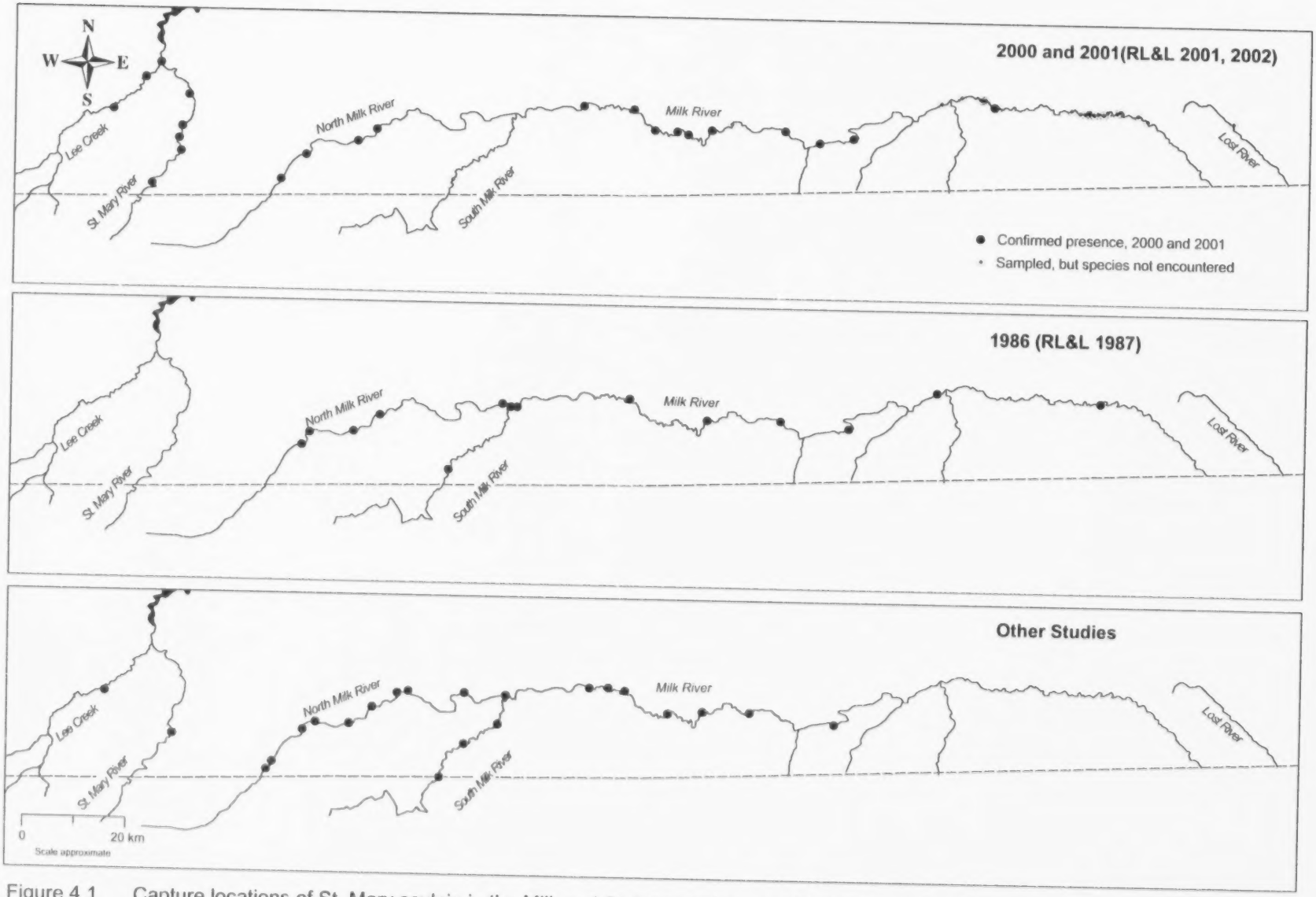


Figure 4.1 Capture locations of St. Mary sculpin in the Milk and St. Mary drainages, historical to present.

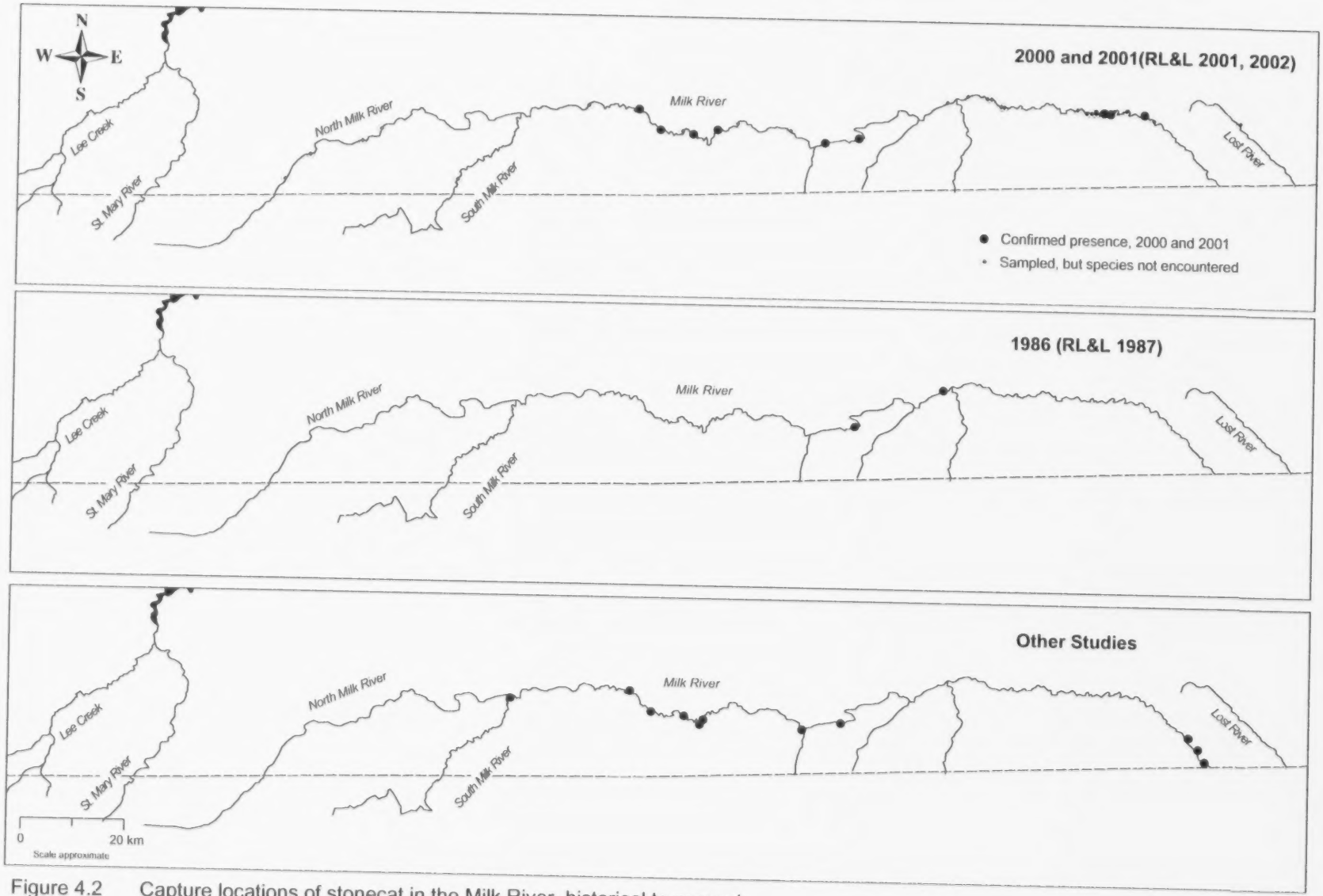


Figure 4.2 Capture locations of stonecat in the Milk River, historical to present.

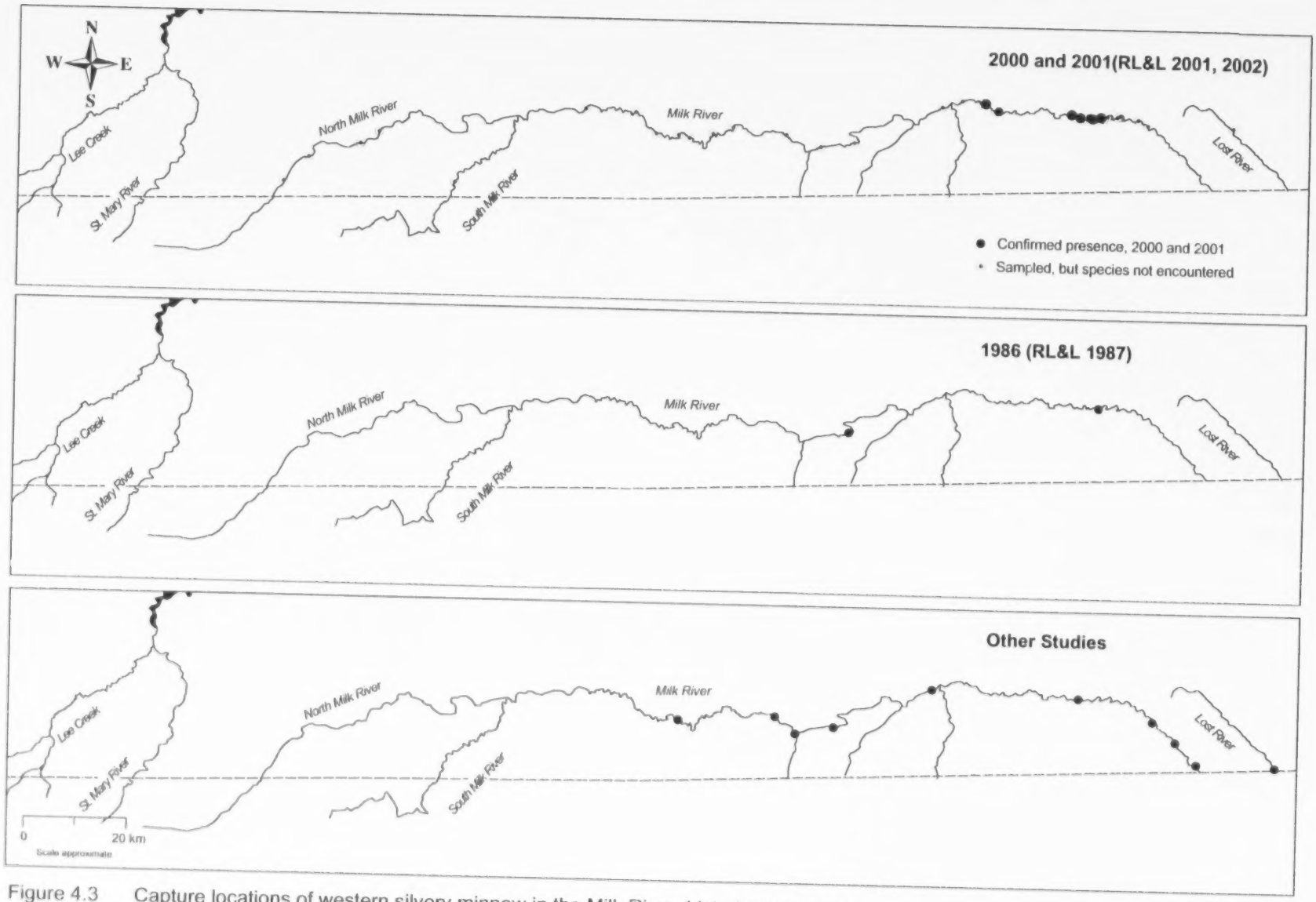


Figure 4.3 Capture locations of western silvery minnow in the Milk River, historical to present.

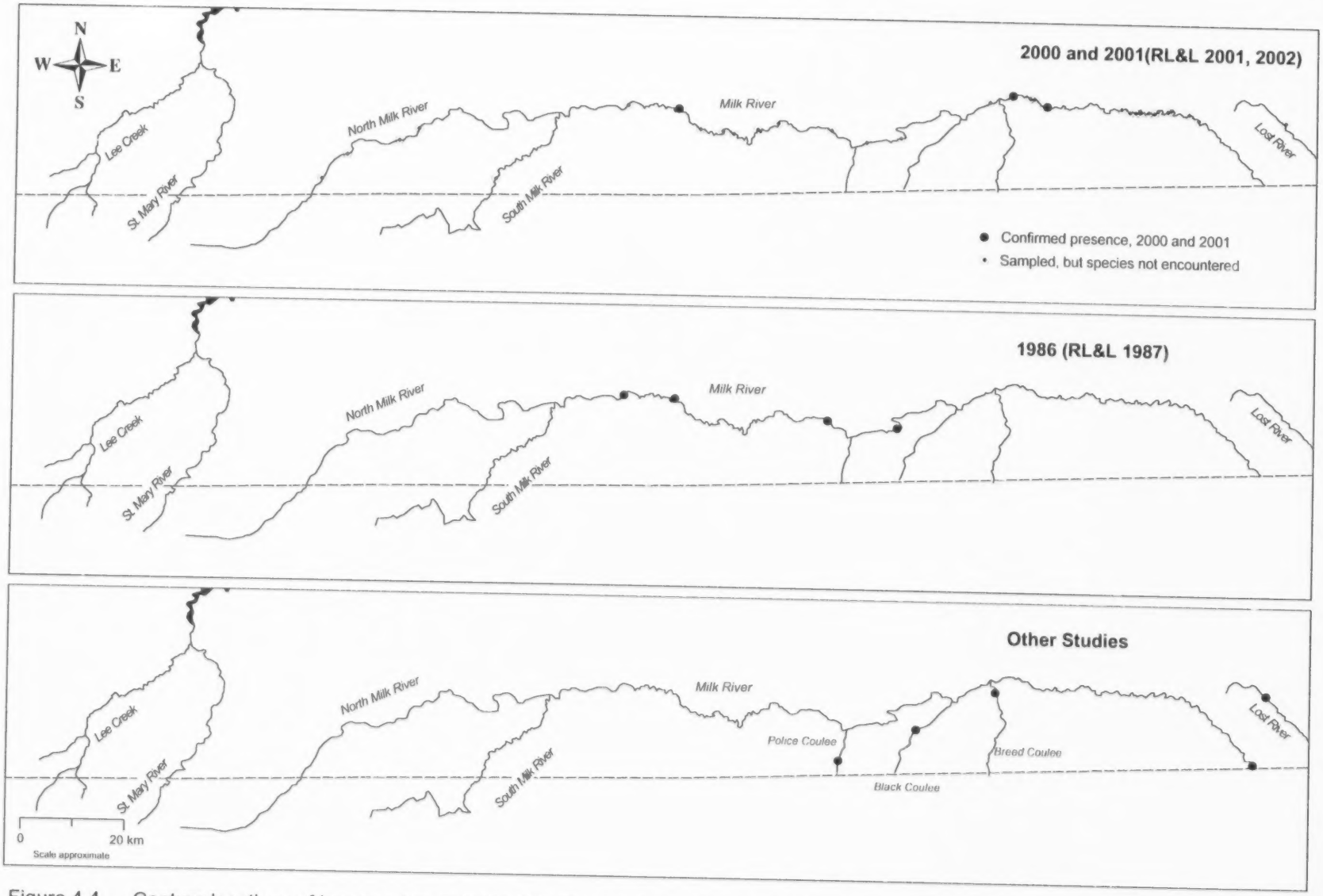


Figure 4.4 Capture locations of brassy minnow in the Milk River drainage, historical to present.

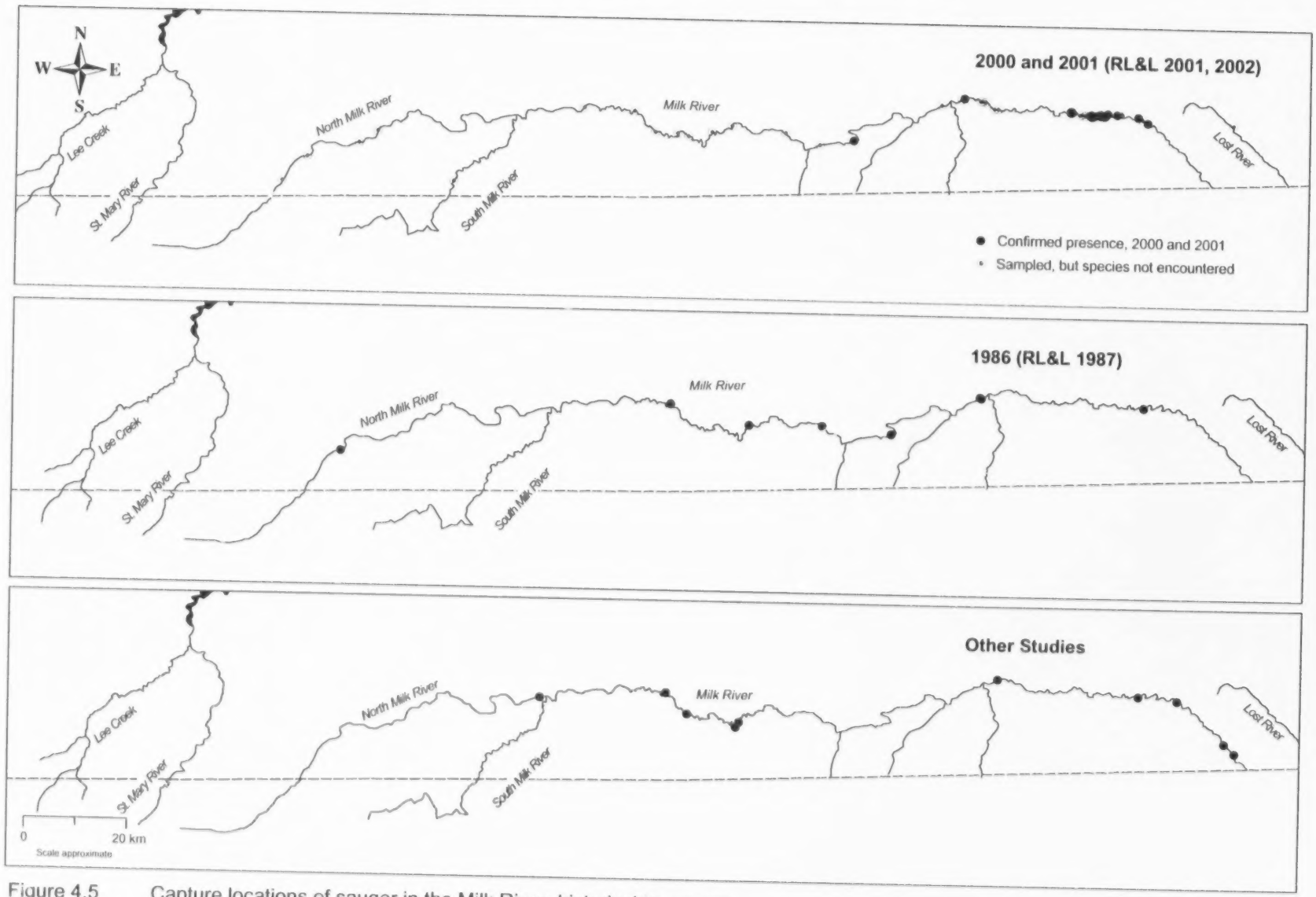


Figure 4.5 Capture locations of sauger in the Milk River, historical to present.

Beach Seining

The overall CPUE (species combined) within the Milk River varied between years. In 2000, the overall catch-per-unit-effort during the summer was 19 fish/100 m^2, while during 2001 the catch-per-unit-effort was 35 fish/100 m^2. During fall 2000, the overall CPUE was 42 fish/100 m^2, while in fall 2001the CPUE was considerably higher (439 fish/100 m^2). Flathead chub comprised most of the catch during fall 2000 and 2001 (27 and 286 fish/100 m^2, respectively).

Most species of interest in the Milk River registered CPUE's <0.5 fish/100 m^2, with the exception of western silvery minnow and sauger (during 2001). These two species had CPUE's of 3 fish/100 m^2 (fall 2001) and 1.4 fish/100 m^2 (fall 2001), respectively.

Comparisons to Historical Data

Comparative historical studies were limited. These studies included RL&L (1987), Paetz (1993), and Stantec (2000). Comparisons with RL&L (1987) were made only for the October data. October was the only sampling period where both years of study used similar electrofishing methods (backpack electrofishing). During August in 1986, the primary method of sampling was boat electrofishing, and in 2000-2001 the primary method of sampling was backpack electrofishing. Due to the greater distances sampled using boat electrofishing (kilometres vs. metres) and the less effective capture of small fish using this method, the relative abundance of most of the species of interest were much lower during boat electrofishing in 1986 than with backpack electrofishing in 2000-2001, and thus these sampling periods were not compared.

St. Mary sculpin

The results indicate that the relative abundance of St. Mary sculpin was higher in the North Milk River in 2000-2001 than in 1986 (Figure 4.6). CPUE values using backpack electrofishing ranged from 3.7 to 10.75 fish/min in 2000-2001, while values in 1986 ranged from 0.02 to 1.86 fish/min. In the mainstem Milk River, the abundance of St. Mary sculpin increased from downstream to upstream, while in 1986, no trends were apparent. Within the mid-sections of the mainstem Milk River, the maximum CPUE values were 2.51 fish/min in 2000-2001, and in 1986 the maximum values were 2.05 fish/min. During both years, St. Mary sculpin were not present or were in very low abundance in the lowermost sections of the Milk River (below Site 2 at the Aden Bridge). For beach seining, CPUE values were relatively similar in 2000-2001 and 1986 (Figure 4.7). In 2000-2001, values ranged from 1.2 to 6.67 fish/100 m^2, while in 1986, values ranged from 0.57 to 10.46 fish/100 m^2.

In the St. Mary River and Lee Creek, the relative abundance of St. Mary sculpin during summer were compared with data collected by Paetz (1993; Figure 4.6). These data were collected at the same locations between the two years of studies. In general, the abundance of St. Mary sculpin varied between years (Figure 4.6). In 2000, abundance in the St. Mary River at Kimball Fairground were 2.77 fish/min, while values reported by Paetz (1993) was 5.76 fish/min. In Lee Creek at the Cardston water intake, Paetz (1993) reported St. Mary sculpin abundance of 3.60 fish/min, while values in 2000 were 16.6 fish/min.

In the Milk River system, Paetz (1993) recorded higher abundance of St. Mary sculpin during summer than in 2000. In the North Milk River (Site 10), Paetz (1993) recorded abundances of

4.56 fish/min, while in 2000 values of 0.83 fish/min were recorded. At the Town of Milk River (Site 4), Paetz (1993) recorded abundance of 3.0 fish/min, while in 2000 values of 0.26 fish/min were recorded. However, similar to the present study, sampling conducted by Stantec (2000) at the Town of Milk River during August (one week prior to the present study), recorded abundance of 0.32 St. Mary sculpin/min.

Stonecat

Relative abundance values of stonecat were much higher in 2000-2001 than in 1986. In 2000-2001, values ranged from 0.1 to 1.8 fish/min, while in 1986 values were 0.09 fish/min at both capture sites (Figure 4.8). The capture results also indicate that there was a broader distribution of stonecat in 2000-2001 relative to 1986.

Western Silvery Minnow

Western silvery minnow exhibited a limited distribution during both the 2000-2001 and 1986 field sampling programs. This species was encountered near the Pinhorn Ranch in both years and farther upstream at the Deer Creek Bridge in 1986. The only data available to compare relative abundance between years was fall beach seine results; in 2000-2001, CPUEs of 1.22 fish/100 m^2 and 4.8 fish/100 m^2 were recorded compared to 0.57 fish/100 m^2 in 1986 (Figure 4.9).

Brassy Minnow

Similar to the western silvery minnow, the brassy minnow also displayed a limited distribution during the 2000-2001 and 1986 field sampling programs. In both years, brassy minnows were restricted to the mid-section of the river. At the two lowermost sites within the mid-section, the beach seine CPUE of brassy minnow was higher in 2000-2001 than in 1986. Backpack electrofishing CPUE was similar between 1986 and 2000-2001 (<0.2 fish/min; Figure 4.10).

Sauger

Since few sauger were captured during October 1986, results from August 1986 are presented. As well, the results of a study by Stantec in 2000 are presented. All studies indicated that the abundances of sauger were low (<1 fish/min), with the exception of Site 2 during fall 2000 (CPUE of 3.46 fish/min; Figure 4.11) and Site 41 during fall 2001 (1.4 fish/min).

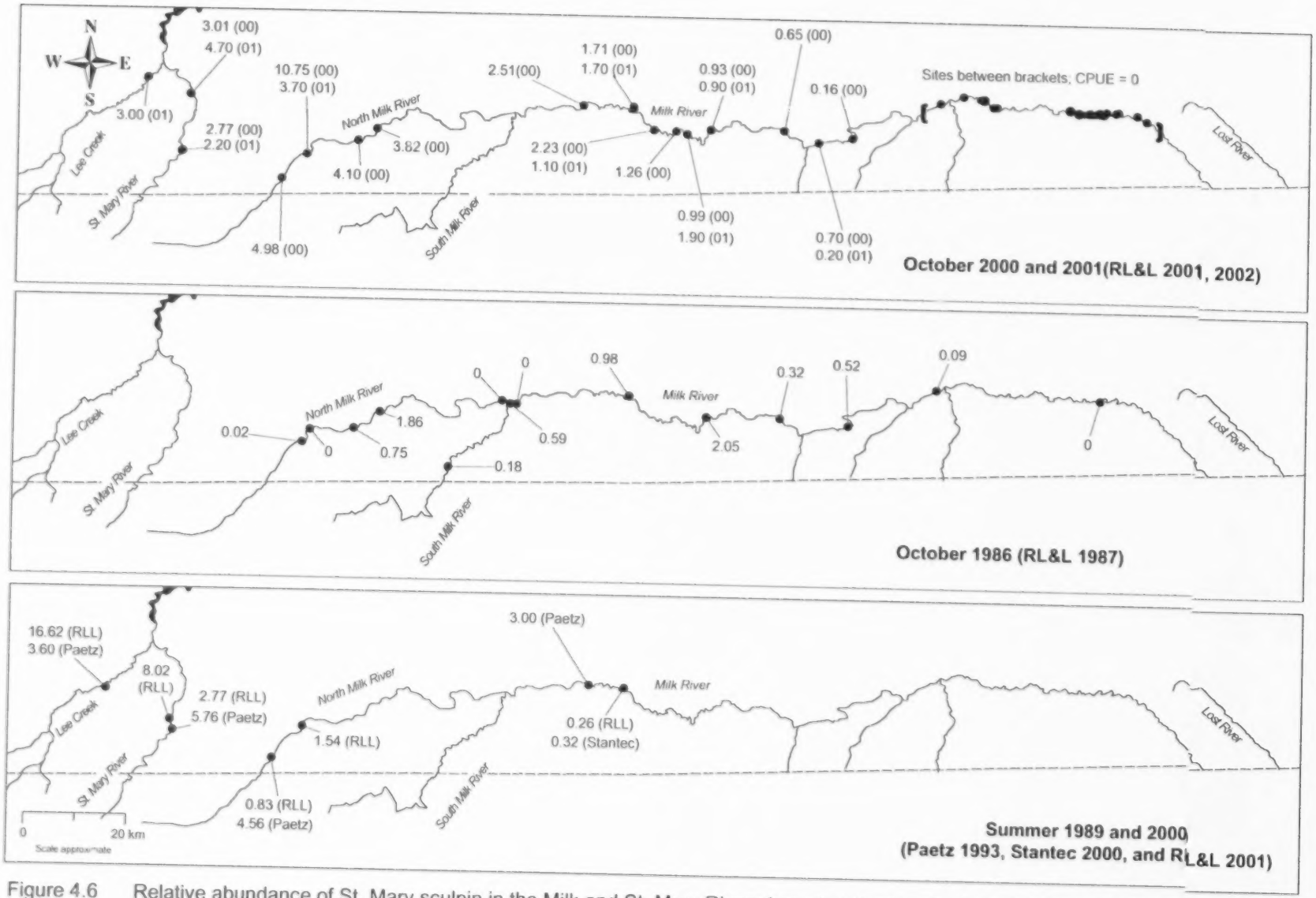


Figure 4.6 Relative abundance of St. Mary sculpin in the Milk and St. Mary Rivers based on backpack electrofishing results (no. fish/min).

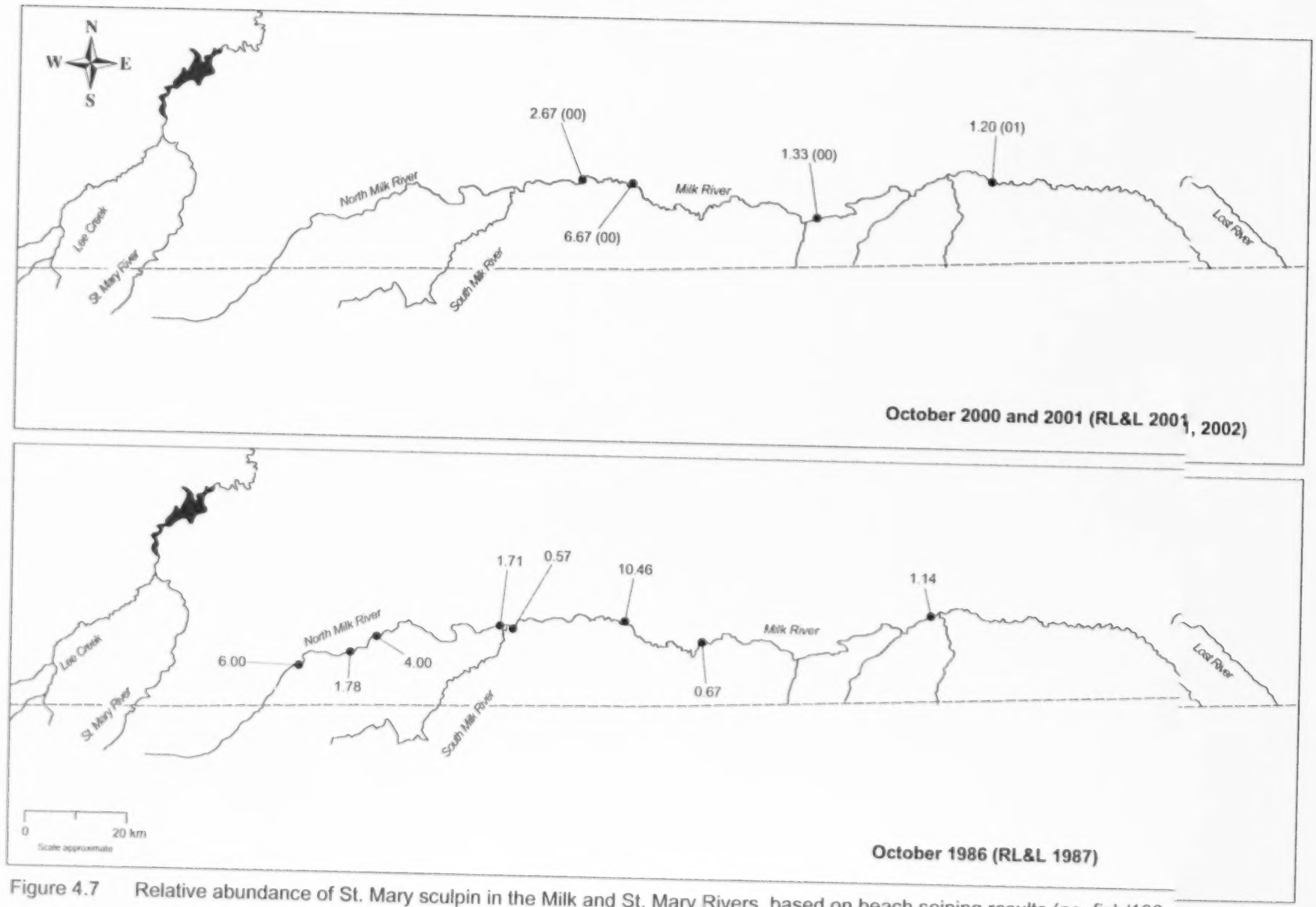


Figure 4.7 Relative abundance of St. Mary sculpin in the Milk and St. Mary Rivers, based on beach seining results (no. fish/100 sq m).

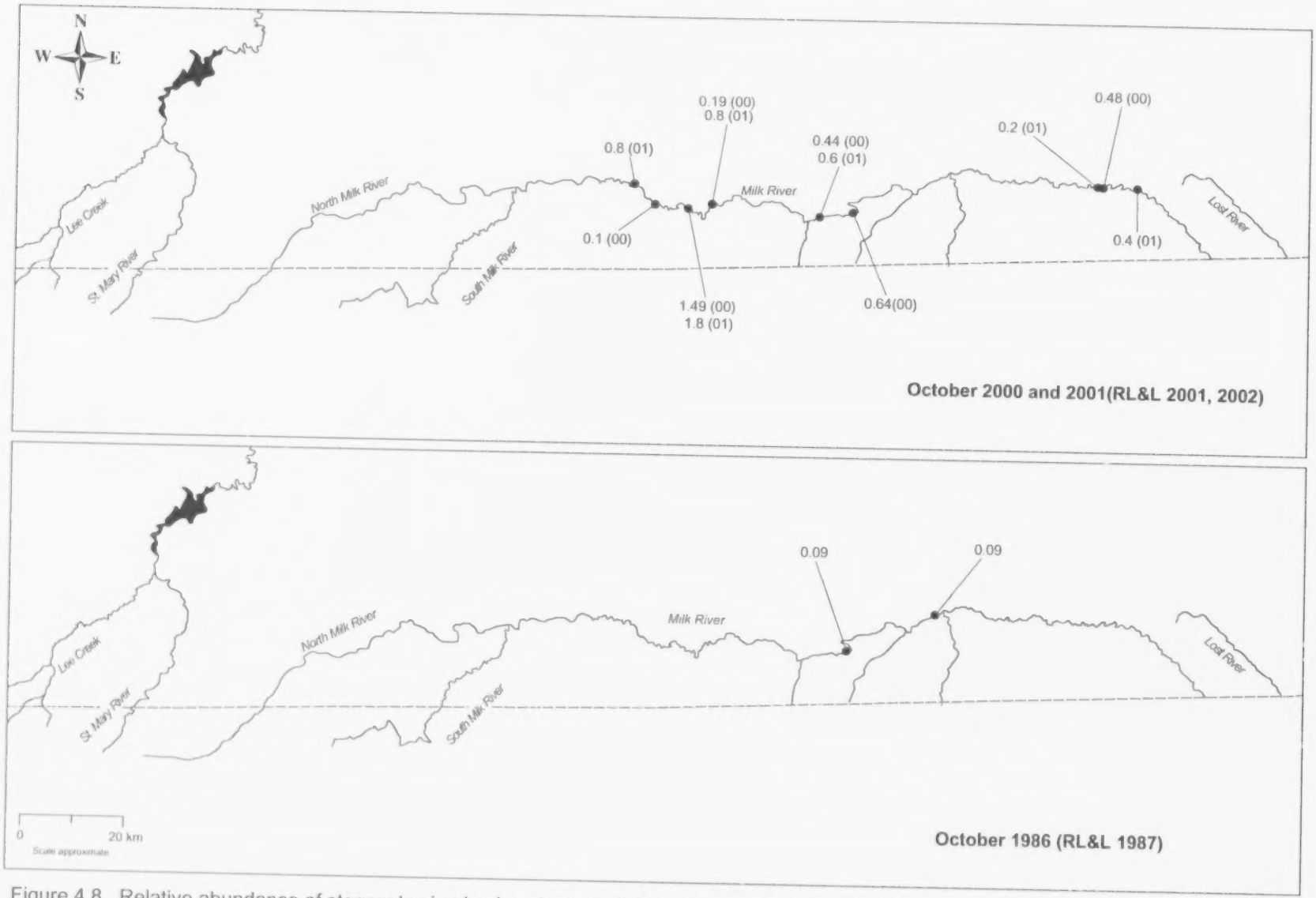


Figure 4.8 Relative abundance of stonecat using backpack electrofishing (no. fish/min) in the Milk River.

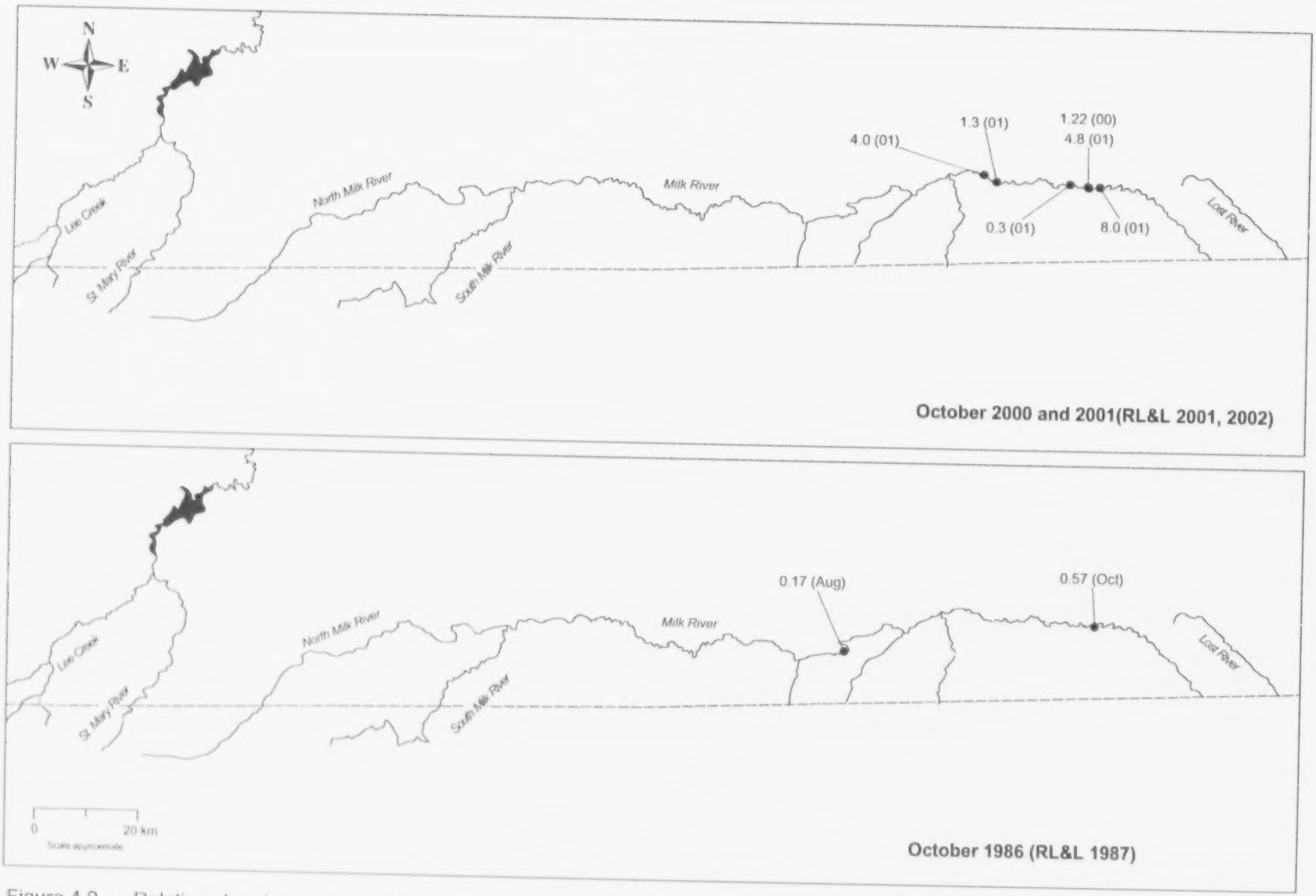


Figure 4.9 Relative abundance of western silvery minnow using beach seining (no. fish/100 sq. m) in the Milk River.

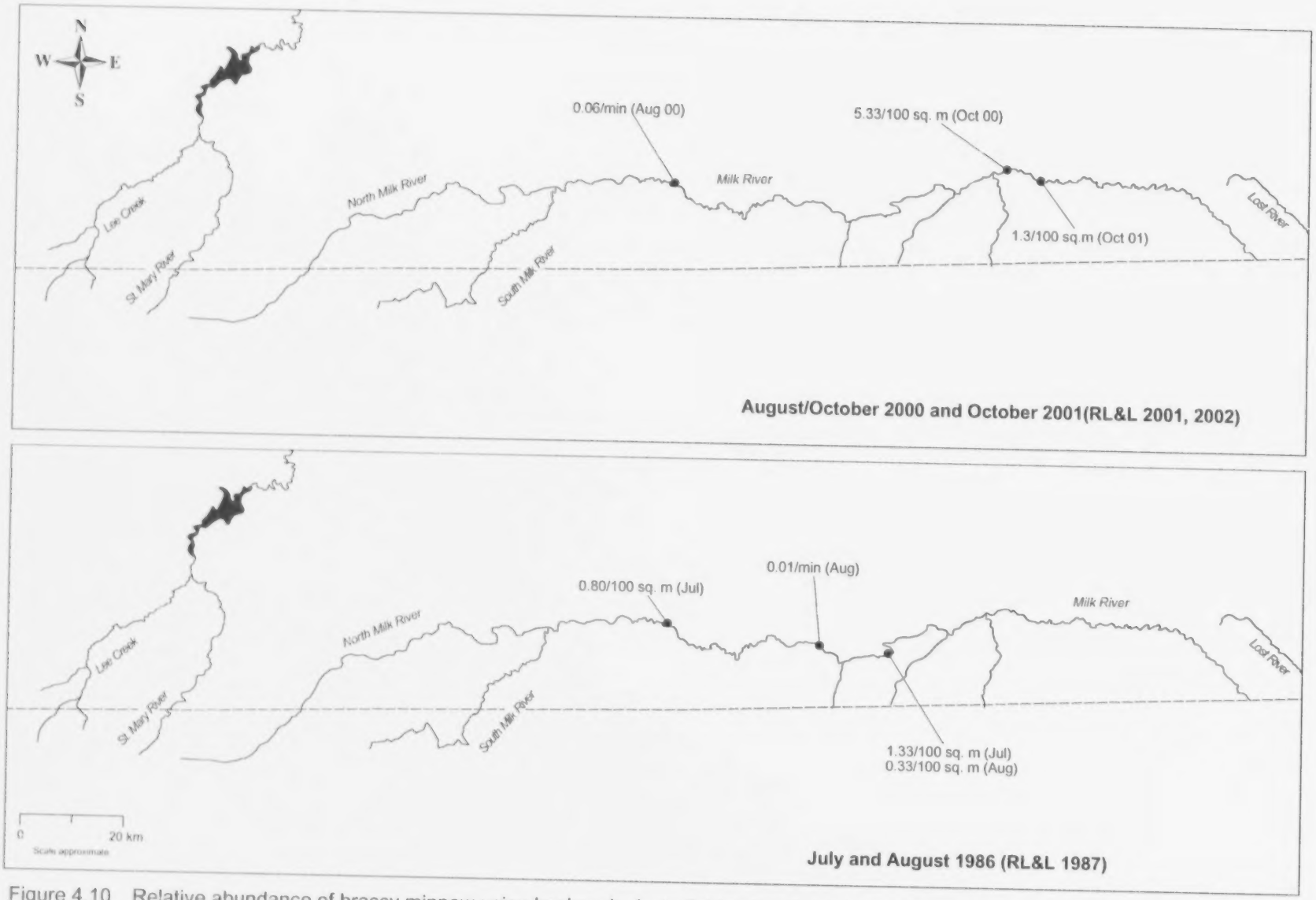


Figure 4.10 Relative abundance of brassy minnow using backpack electrofishing (no. fish/min) and beach seining (no. fish/100 sq. m) in the Milk River, historical to present.

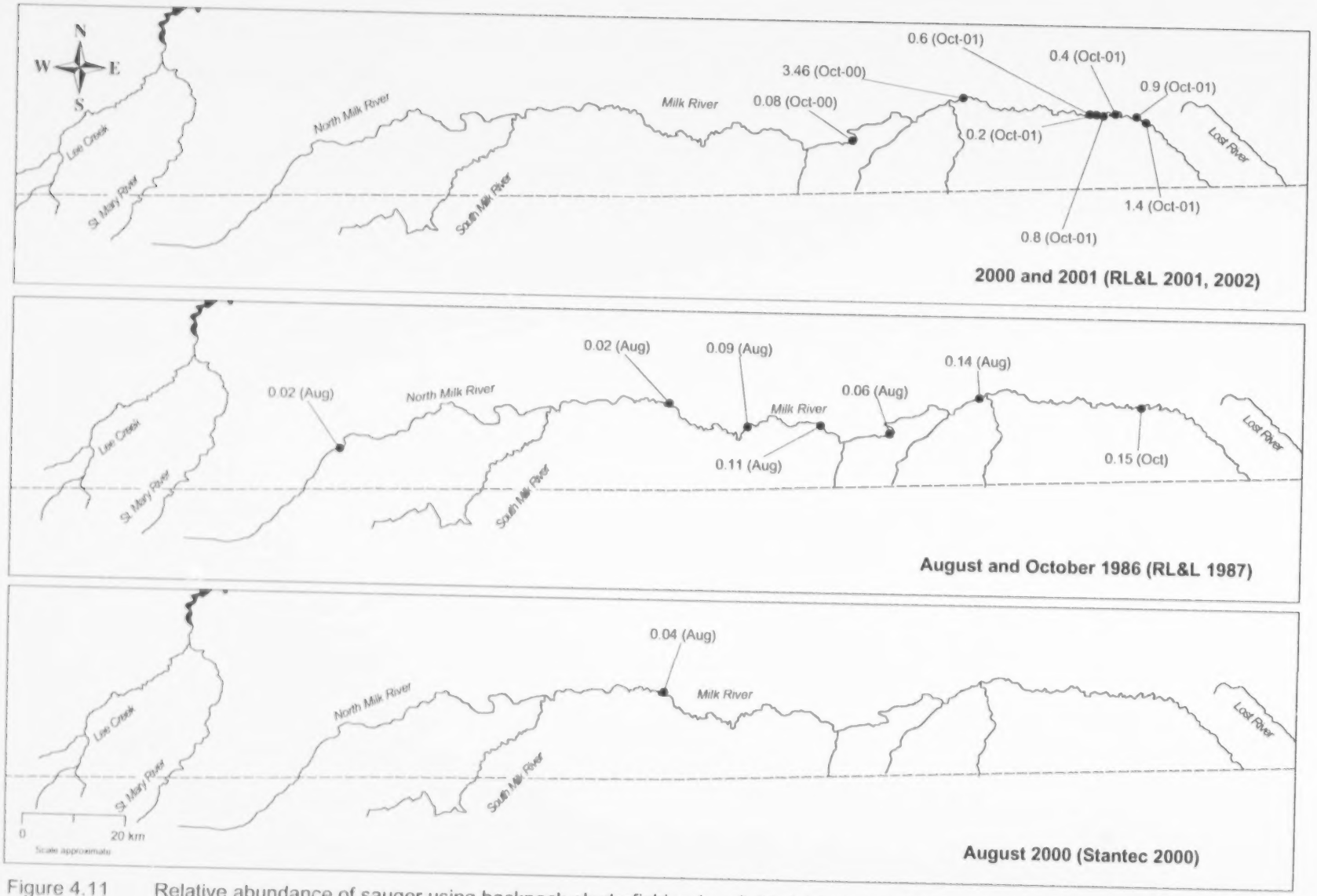


Figure 4.11 Relative abundance of sauger using backpack electrofishing (no. fish/min) in the Milk River, historical to present.

4.1.4 Life History Characteristics

St. Mary sculpin exhibited a unimodal length frequency distribution in all three drainages and during both years of study. In the Milk River, individuals captured in 2001 were slightly larger than in 2000 (mean fork lengths of 74 and 56 mm, respectively). In 2001, the 60 - 69 mm length category represented the highest frequency, whereas in 2000, the 50 - 59 mm length category represented the highest frequency. In the St. Mary River, the length distribution was quite similar during both years (means of 51 and 56 mm). In contrast, two distinct length categories were evident between years in Lee Creek. In 2000, the 30-39 mm length category represented the highest frequency, while in 2001 the highest length frequency group was 70-79 mm group (means of 40 and 75 mm, respectively). In the St. Mary River, Roberts (1988) documented that the smallest mature female was 52.3 mm total length, while the largest mature female was 80 mm. The maximum length of St. Mary sculpin documented from the Milk River was 108 mm total length (Roberts 1988), whereas in the present study the maximum fork length was 114 mm.

A study conducted in the Flathead River, BC by Hughes and Peden (1984) documented that shorthead sculpin (*Cottus confusus*) had standard lengths (SL) that ranged from 25 to 85 mm, and a mean length of 52 mm. Analysis of ageing structures (otoliths) indicated that young-of-the-year were 37.0 ± 1.4 mm in standard length. 1-year-old females were 48.6 ± 2.6 mm and 1-year-old males were 64.4 ± 4.9 mm, while a 2-year-old female had a standard length of 71.4 mm.

Gasser et al. (1981) documented 6 year classes for shorthead sculpin in the Big Lost River in Idaho. The authors found that young-of-the-year of this species attained lengths of approximately 33 mm (SL) by the end of the first growing season, and that length increases approximately 10-12 mm a year. Lengths of other ages determined included: Age-2 fish were 46.7 mm, Age-3 were 58.9 mm, Age-4 fish were 70.7 mm, Age-5 fish were 82.1 mm, and Age-6 fish were 91.0 mm (SL).

Age-at-maturity for St. Mary sculpin in the St. Mary River drainage was documented at Age-2 (Roberts 1988), while sculpin in the Big Lost River matured at Age-3 (Gasser et al. 1981).

Stonecats had a slightly higher mean fork length in 2001 than in 2000 (152 vs. 132 mm, respectively); however the range in length was greater in 2000 (32 to 269 mm vs. 80 to 225 mm, respectively). Nelson and Paetz (1992) reported that stonecat have a maximum length of 310 mm in Canada, and a maximum recorded length of 250 mm in the Milk River at Deer Creek Bridge.

Western silvery minnow were considerably larger in 2001 than 2000. In 2000, the mean fork length was 41 mm, while in 2001 the mean length was 97 mm. Fork lengths in 2001 ranged from lengths 29 to 140 mm. Nelson and Paetz (1992) indicated that the maximum fork length of western silvery minnow documented was 150 mm, while in Alberta the maximum was 100 mm (near the Town of Milk River).

Few brassy minnow were captured during the two years of study (n=10). During that time, the mean fork length was 29 mm, with a range of 23 to 48 mm. Within Alberta, Nelson and Paetz (1992) reported a maximum length of 81 mm from Halfbreed Creek near Aden (a tributary to

the Milk River).

Sauger were captured at three sites in 2000 and at ten sites in 2001. There was a greater range in fork lengths during 2001 than 2000. In 2000, fork lengths ranged from 343 to 458 mm with a mean of 381 mm, while in 2000 fork lengths ranged from 76 to 558 mm with a mean of 123 mm. Maximum length of sauger in Alberta are reported at 596 mm, which was captured in the Milk River (Nelson and Paetz 1992).

4.2 Habitat

4.2.1 Habitat Use and Requirements

4.2.1.1 St. Mary sculpin

Very little is known about the habitat requirements of the shorthead sculpin (referred as St. Mary sculpin in this document) (Scott and Crossman 1973; Nelson and Paetz 1992), particularly those occurring in Alberta. Shorthead sculpin generally inhabit riffles of small, cold streams (Scott and Crossman 1973; Lee et al. 1980 from Peden and Hughes 1984). Peden and Hughes (1984) determined that shorthead sculpin in the Flathead River, British Columbia were most abundant in areas of slow current and rocky bottoms; however, it was documented that sculpins were not always associated with riffle habitats. The authors also indicated that shorthead sculpin were generally located in areas that were not heavily sedimented. Similarly, RL&L (1987) recorded that sculpin were abundant in the North Milk and upper Milk rivers, in areas of large gravel and cobble, with relatively low silt deposition.

Spawning is presumed to occur in May or June. Eggs are deposited on or under rocks. Males have been observed guarding and fanning the nest (Lee et al. 1980 from Peden and Hughes 1984; Roberts 1988). Shorthead sculpin feed primarily on aquatic insects (Peden and Hughes 1984; Roberts 1988). It is believed that juveniles and adults of this species do not undertake extensive migrations (Peden and Hughes 1984).

In the present study, St. Mary shorthead sculpin generally used riffle and shallow run habitats, in low to moderate velocities and low silt depths. Substrate size consisted primarily of gravel and cobble. The distance of a captured fish from cover were also measured during sampling; most sculpin were closely associated with cover, and rock was the predominant type of cover.

4.2.1.2 Stonecat

The habitat requirements of stonecat are poorly understood (Scott and Crossman 1973; RL&L 1987). However, stonecats are most commonly associated with large substrate in deep pools and rocky bottoms associated with riffles in large streams, but are apparently adaptable to many habitat types (Nelson and Paetz 1992). In the Milk River, stonecats have been located in areas with boulder rip-rap lining bridge abutments (i.e., at Deer Creek and Aden bridges; Clayton and Ash 1980; RL&L 1987).

Spawning is presumed to occur in June or July in areas with large gravel or rocky substrate (Scott and Crossman 1973; Nelson and Paetz 1992). A mass of sticky eggs are deposited in nests beneath the rocks. Nests are guarded by both parents and the young-of-the-year probably rear in close proximity to the spawning site as both parents protect the young during

early juvenile development (Brown 1971).

Stonecats feed primarily on aquatic insects and sometimes on small fishes, molluscs and plant material (Scott and Crossman 1973; Nelson and Paetz 1992). It is thought that they use their barbels to locate food and that they feed primarily at night (Nelson and Paetz 1992).

Overwintering stonecats require adequate stream flow and the presence of rocks for cover. As such, it was speculated that low winter flows in the Milk River may limit the availability of suitable overwintering areas for stonecats (RL&L 1987).

In the present study, stonecat were encountered predominantly in shallow run and flat habitat types, however, they were also encountered in run and riffle boulder garden habitat types. Velocities tend to be low to moderate, and low silt depths. Substrate size consisted of a mixture of small and large substrate, but all stonecats were found residing between and/or under cobble and boulder substrate. Water depth was limited in both years of study.

4.2.1.3 Western Silvery Minnow

Very little is known about the biology and habitat requirements of the western silvery minnow (Houston 1998; Nelson and Paetz 1992). Silvery minnow prefer quiet waters in rivers with slow to moderate velocity or in the inshore waters of lakes (Willock 1969; Scott and Crossman 1973; Jones et al. 1978). Substrates generally consist of mud, sand, and gravel substrates, but those that are not covered by silt (Trautman 1957; Willock 1969; Jones et al. 1978). Willock (1969) reported that unlike the brassy minnow, the silvery minnow was not captured in small tributaries, but rather in the mainstem habitats of the Milk River.

Spawning probably occurs in backwaters in slower moving water (Scott and Crossman 1973; Houston 1998). It is believed that silvery minnows spawn in May, although no observations have been published (Scott and Crossman 1973; Houston 1998). This species lays non-adhesive eggs over riffles or in quiet shallow backwater areas (Raney 1939). Trautman (1957) determined that spawning only occurs in areas of low silt deposition.

Rearing of the silvery minnow occurs near quiet shoreline areas and in the vicinity of tributary mouths (Raney 1939 from Houston 1998; RL&L 1987). The diet of silvery minnow consists primarily of algae (Willock 1969; RL&L 1987; Nelson and Paetz 1992).

In the Milk River, overwintering habitat for the western silvery minnow may be limited in some years due to low winter flows and insufficient water depths; however, RL&L (1987) noted that based on captures during November (Clayton and Ash 1980), overwintering is possible in the lowermost reaches of the Milk River.

During the present study in 2000, western silvery minnow were encountered in shallow flat and run habitat types, with low to moderate velocities. The substrate consisted predominantly of sand and silt deposition was low. In 2001 during summer, all silvery minnows were captured at the mouth of coulees. Due to the extremely dry weather conditions, the coulees in the lower Milk River were dry, but some of the water from the mainstem backed-up into the coulee. These areas provided a refuge from the mainstem water flow, which also provided depth and turbidity as cover. During fall 2001, the water levels had receded to the extent

where there were only isolated pools of water in which fish could not emigrate.

A study currently being conducted in the Milk River from the international border downstream to the Fresno Reservoir in Montana, determined that western silvery minnow were encountered in flat and run habitat types (65% inside bend, 20% channel crossover, and 15% outside bend). Mean water depths were 0.55 m and mean velocities were 1.5 m/s. Substrate consisted primarily of silt and sand (46% and 53%, respectively; data obtained from Sean Stash, Montana State University).

4.2.1.4 Brassy Minnow

Similar to the western silvery minnow, very little is known about the biology and habitat requirements of the brassy minnow (Scott and Crossman 1973; Nelson and Paetz 1992). Paetz and Nelson (1970) noted that this species occurs in areas of slow current in the Milk River and its associated tributaries. Willock (1969) recorded brassy minnow in a number of the tributaries originating in the Sweetgrass Hills of Montana and indicated a preference for pool habitats. Dymond (1939; *In* Scott and Crossman 1973) reported that the brassy minnow inhabits cooler waters than the silvery minnow. Similarly, RL&L (1987 and 2001) found that the range of silvery and brassy minnows did not overlap. However in contrast, Willock (1969) and Nelson and Paetz (1992) found that the distribution of these two species did overlap to a small degree.

Spawning probably occurs in May or June and it has been suggested that eggs are deposited in quiet water over a silt bottom (Scott and Crossman 1973). No information was available on the rearing or overwintering habitat of the brassy minnow. The diet of brassy minnow consists mainly of phytoplankton and other algae, zooplankton and some aquatic insects primarily feeds on algae (Willock 1969; RL&L 1987; Nelson and Paetz 1992).

During the present study in 2000, brassy minnow were present in two very different habitat types in the Milk River. One brassy minnow was captured in fast flowing, riffle habitat, where the substrate consisted predominantly of gravel. The other eight brassy minnows were captured in a deep, backwater area in the lower Milk River near Ross' Ranch. This habitat was more typical then the fast flowing riffle habitat (Willock 1969). These brassy minnows were captured in a backwater that was 1.1 m in depth and the velocity was negligible (<0.01 m/s). Substrate consisted predominantly of sand and some silt. Cover types included depth and turbidity and large woody debris. In 2001, only one brassy minnow was encountered; this fish was captured in a shallow, sandy snye just downstream of Ross' Ranch.

4.2.1.5 Sauger

Sauger occur in both lakes and rivers within their geographic range. However, in Alberta, sauger are found only in rivers (Nelson and Paetz 1992). Sauger appear to be tolerant of silty waters, such as those of the Milk River and South Saskatchewan. Spawning occurs in the spring (end of May/beginning of June) over gravel and boulder substrate (Scott and Crossman 1973). This species feeds mostly on small fishes and aquatic insects (Nelson and Paetz 1992).

Willock (1968) found that sauger in the Milk River are commonly associated with pools containing rocky substrate. The author also suggested that the more eastern tributaries are the

major spawning grounds for this species in the Milk River, since young saugers were captured at these locations, but were absent from similar habitats in tributaries farther west.
In general, sauger were encountered in moderately shallow run and flat habitat types, with low to moderate water velocities. In 2001, most fish were captured in isolated pools, however this could not be considered a preferred habitat since these fish had no other option. Sand was the dominant substrate type (mean of 81%). Silt depth was generally low (< 0.10 m). Cover was represented primarily by depth and turbidity.

4.2.2 Habitat Suitability for the Species at Risk

St. Mary sculpin

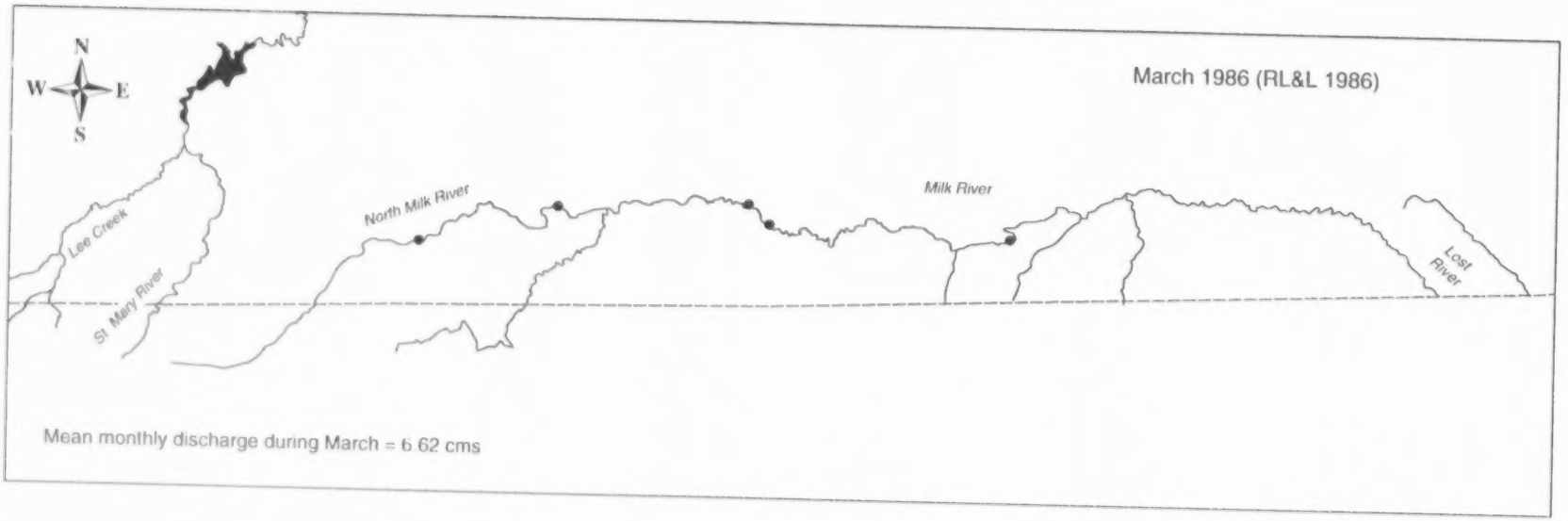
St. Mary sculpin were moderately abundant throughout the St. Mary River and most of the Milk River with the exception of the lowermost sites (low abundance). This indicates that spawning, rearing, and feeding habitat for St. Mary sculpin are not limiting within these systems. Similarly, overwintering habitat is well represented in both rivers, provided there is adequate stream flows. Surveys conducted in winter 1979/1980 and 1986 confirmed the presence of St. Mary sculpin overwintering throughout the Milk River (Clayton and Ash 1980; RL&L 1986; Figure 4.12). However, given the very low discharge during December (0.06 m^3/s), fish may be subjected to unsuitable habitat conditions during this winter (2001/2002).

Stonecat

Stonecats are generally associated with large substrate during the various life requisite functions (i.e., spawning, rearing, feeding, and overwintering). In the Milk River, stonecat were distributed primarily in the mid to lower reaches. In the lower reaches, coarse substrate was not prevalent but occurred in isolated patches. Stonecats often occupied these isolated patches where available. In the mid reaches of the Milk River, high quality habitats were located between Gold Spring Park and the Weir Bridge (i.e., presence of extensive areas of boulder-garden habitat types). A potential rearing site based on the high abundance of juvenile stonecat captured was located at Site 25 (1.5 and 1.8 fish/min in 2000 and 2001, respectively). Overwintering habitat for stonecats is likely limited in the Milk River during most years due to the very low winter flows (see Figure 3.9). In November 1979, numerous stonecats (n=29) were captured from a pool in the vicinity of the Deer Creek Bridge, indicating probable overwintering use in that area (Clayton and Ash 1980). During the present study, no pools were observed in this particular vicinity (maximum depth in 2000 was 0.65 m, while in 2001 the maximum depth was 0.41 m), indicating low overwintering suitability.

Western Silvery Minnow

Rearing habitat for western silvery minnow consists of quiet waters in rivers with slow to moderate velocity (Willock 1969; Scott and Crossman 1973). This type of habitat, as well as suitable feeding areas for the western silvery minnow appeared to be abundant in the lower reaches of the Milk River during the study. However, this was not the case in fall 2001. Due to the extreme drought conditions and early closure of diversion headgates, only isolated pools were present in the lower Milk River near the Pinhorn Ranch during the fall sampling program. Fish in this area were stranded in shallow isolated pools.



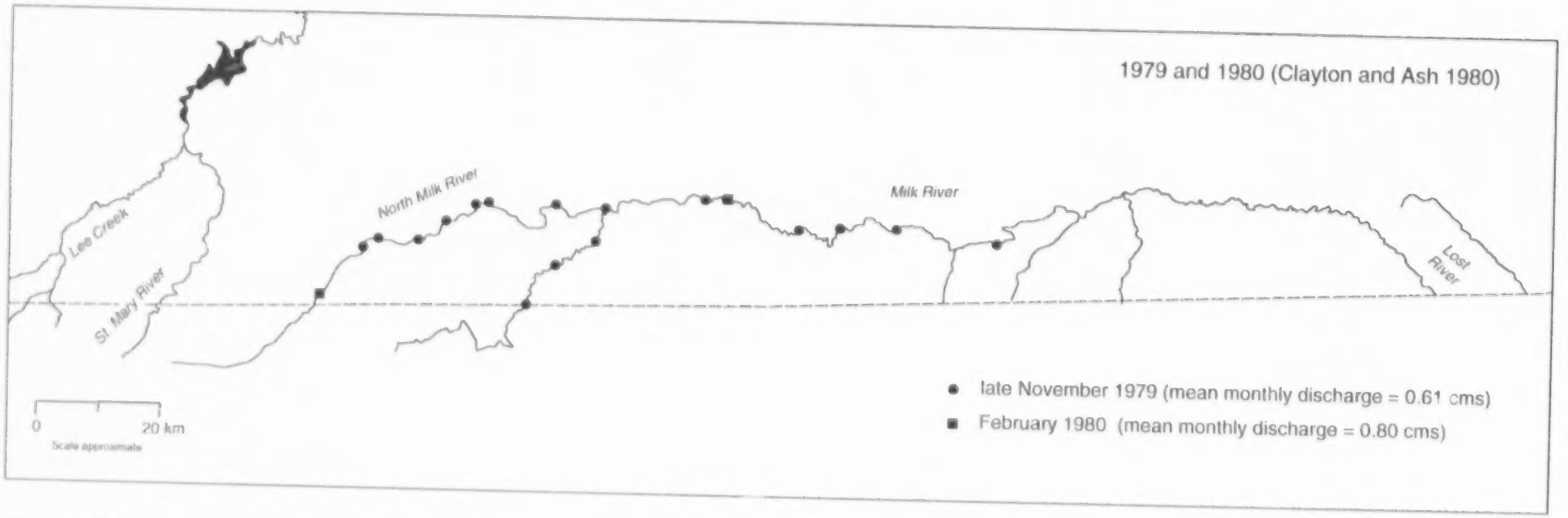


Figure 4.12 Confirmed overwintering sites for St. Mary sculpin in the Milk River.

Overwintering habitat has been documented in the lower reaches of the Milk River. Clayton and Ash (1980) documented two silvery minnows in the vicinity of the Deer Creek Bridge. Although overwintering areas have previously been documented, low or no winter flows may reduce overwintering potential in some years (e.g., winter 2000/2001 and 2001/2002). Although suitable rearing, feeding, and overwintering habitat appear to be widely available in the lower Milk River, few western silvery minnow have been documented. Other factors are evidently influencing their distribution and abundance in this river system.

Previous investigators have speculated about possible factors limiting the abundance of western silvery minnow in the Milk River. Trautman (1957) determined that similar to the eastern silvery minnow, the western silvery had a low tolerance for suspended sediment. He suggested that increased turbidity was responsible for the extirpation of the eastern silvery minnow in Ohio and could affect the status of the western silvery minnow (from Houston 1998). Willock (1968) also suggested that the loss of silvery minnow from extensive areas in the US was attributed to increased turbidity and the disappearance of aquatic vegetation due to heavy silt deposition. Willock (1968) speculated that prior to 1900, the silvery minnow might have been well established in the upper reaches of the Milk River. He concluded that the population likely declined rapidly in the early 1900's due to large increases in turbidity from the diversion of irrigation water into the Milk River. Houston (1998) indicated that the habitat potential of the western silvery minnow could be limited by habitat degradation, including agricultural activities.

Overall Limiting Habitat Characteristics in the Milk River

Several habitat features have been identified as limiting fish distribution and abundance in the Milk River; these include low winter flows, high suspended sediment levels, high siltation of the substrate, low winter dissolved oxygen (levels as low as 1.6 mg/L, Noton 1980; see note at end of this section) in some years, and limited availability of deep water refugia (RL&L 1987). These features adversely affect the fish resources over the long term, with conditions improving or declining on a year- to-year basis largely in relation to the flow regime.

Of major concern at present is the limited availability of water for fish overwintering during the winter of 2001/2002. During fall 2001, there was no flowing water in the lower sections of the Milk River (Km 40 to 60 and downstream); only small isolated pools with shallow water depths were present. Thus fish will not be able to emigrate if unsuitable living conditions persist (i.e., pools freezing to the bottom and low dissolved oxygen levels causing anoxic conditions). In the mid section of the river (Km 200 at the Town of Milk River), the river was flowing in December. However, these flows were approaching zero (0.06 m^3/s) and were the second lowest recorded in 93 years. It is likely that large numbers of fish (all species) will not survive the winter of 2001/2002 (particularly in the mid to lower sections of the river). The current conditions during the winter 2001/2002 could be devastating to fish populations that are presently considered rare or "at risk". If, in the worst case, these populations are extirpated, it is likely that western silvery minnow, stonecat and sauger could recolonize from downstream sections near the Fresno Reservoir (see Figure 1.1); the St. Mary sculpin could recolonize from the St. Mary River (through the diversion canal).

However, brassy minnow have not been previously recorded from downstream sections near the Fresno Reservoir (pers. com. S. Stash). As such, there is a concern that brassy minnow

may not re-establish in its former range. Although there is a source for recolonization for most species, it could take many years to develop self-sustaining, viable populations.

Note: *A late winter study was conducted in March 2002 (funded by the Department of Fisheries and Oceans). The report is presented in Appendix F. Results indicate that water availability and depth were the major limiting factors for the survival of overwintering fish during winter 2001/2002. Approximately 5% of the surface area of water that was available to fish during July was available during March; also, the water available in winter 2001/2002 was in the form of non-flowing, isolated pools.*

5.0 MANAGEMENT IMPLICATIONS AND FUTURE DIRECTIONS

In assessing the status of the fish species at risk within the Milk and St. Mary river drainages, two primary questions were to be addressed, including:

1) Are the populations of the three fish species at risk increasing, stable or declining?
2) What habitat variables are key to ensure the continued viability of the species at risk?

1) Are the populations of the Species at Risk increasing, stable or declining?

St. Mary Sculpin

Comparison of fall abundance data between the present study (2000-2001) and 1986 suggested that the status of St. Mary sculpin has ***increased in the North Milk River and the mainstem***, while their abundance has remained ***stable in the lower Milk River*** (see Figure 4.6). *[Note: this assessment does not take into consideration the possible adverse affects of the winter 2001/2002 season.]*

In the North Milk River during 2000-2001, catch effort ranged from 3.7-10.8 fish/min with a mean of 5.47 fish/min, while in 1986 the catch effort ranged from 0-1.9 fish/min with a mean of 0.66 fish/min; an increase of 8-fold. In the mainstem Milk River, the abundance of St. Mary sculpin was 2-fold higher in 2000-2001 than 1986 (means of 1.21 and 0.64 fish/min, respectively). Between years in the present study (i.e., 2000 vs. 2001), the abundance of the St. Mary sculpin was relatively similar for both the North Milk River and mainstem. In the North Milk River, the mean abundance was 5.9 fish/min in 2000, while the mean was 3.7 fish/min in 2001. In the mainstem, the mean abundance was 1.2 fish/min in both years. St. Mary sculpin was absent from the South Fork of the Milk River (i.e., it was dry in 2000-2001), although this species has previously been documented in this section of river (RL&L 1987). In the lower Milk River, abundances of St. Mary sculpin were similar between the present study and 1986; both years indicated very low abundance.

When comparing summer abundance values in the Milk River between the present study and previous studies, results indicate that a study conducted in 1989 (Paetz 1993) found much higher abundances in the North Milk River than the present study (0.8 vs. 4.6 fish/min). The large differences in abundance between the 1989 and 2000 studies could be related to sampling biases (i.e., sampling only key habitat areas within a site as opposed to sampling representative areas within a site). Another survey, which was conducted by Stantec (2000) at the Town of Milk River revealed similar results to the present study (CPUE for both studies was 0.3 fish/min). In the St. Mary River, Paetz (1993) documented higher abundances than the present study (2.8 vs. 5.8 fish/min). However, immediately downstream of the comparative site, the present study documented a catch effort of 8.0 fish/min. The abundance of St. Mary sculpin in Lee Creek was considerably higher during the present study than values

recorded in 1989 by Paetz (1993) (16.6 vs. 3.6 fish/min, respectively; 4-fold difference).

Western Silvery Minnow
Based on a comparison of results of the present and previous studies, it appears that the status of western silvery minnow is ***stable, but*** that this species is ***rare*** in the Milk River. *[Note: this assessment does not take into consideration the possible adverse affects of the winter 2001/2002 season.]*

Very few specimens of western silvery minnow have previously been documented in the Milk River (Willock 1969; Clayton and Ash 1980; RL&L 1987) and few were documented in the present study during 2000. However in 2001, higher numbers of western silvery minnow were captured (n=39). The higher numbers of silvery minnow captured likely do not indicate that the population has increased, but rather that sampling efficiency was much higher during fall 2001. Due to the extremely low water levels, isolated pools were present during fall throughout the lower Milk River, which allowed for increased sampling efficiency.

Present and historical data indicate that the western silvery minnow is rare in the Milk River drainage. Houston (1998) suggested that the western silvery minnow should be considered vulnerable in Canada given its restricted distribution and rarity.

Stonecat
Based on the available data, the population of stonecat in the Milk River appears relatively ***stable, but*** is characterized by ***low abundance.*** *[Note: this assessment does not take into consideration the possible adverse affects of the winter 2001/2002 season.]*

The distribution of stonecat documented in the present study was similar to previous studies (see Figure 4.1). Comparisons in Section 4.1.3 (Fish Abundance) indicate that stonecats were more abundant in 2000-2001 than in 1986 (mean of 0.66 and 0.09 fish/min, respectively). However, CPUE values were low in both years (highest recorded CPUE was 1.8 fish/min at Site 25).

2) <u>What habitat variables are key to ensure the continued viability of the Species at Risk?</u>

St. Mary Sculpin
Results indicate that St. Mary sculpin generally occupy riffle and shallow run habitats, characterized by low to moderate velocities, and gravel and cobble substrate. These types of habitat variables were most prevalent in the mid to upper sections of the Milk and North Milk rivers, and throughout the St. Mary River drainage.

Western Silvery Minnow
Western silvery minnow was documented only in the lower Milk River. This species was associated with sandy, shallow flat and run habitat types, characterized by low to moderate velocities. Silvery minnows were also found residing at the mouth of coulees, where there was refuge from the river current, and depth and turbidity provided cover.

Stonecat
The results during the present study indicate that stonecat are generally associated with large

rock substrates located in shallow flats, runs and riffle/boulder gardens; associated velocities were typically low to moderate. Although these types of habitat variables were present in the mid to upper sections of the Milk River, stonecat were primarily encountered in the mid to lower sections of the Milk River.

Additional Factors

Discharge likely represents the major habitat variable determining the distribution and relative abundance (hence viability) of the species at risk. If stream flows are reduced substantially in a given year, particularly during winter, overwintering success for most fish species could be jeopardized. In 2001, discharges in December were at extremely low levels (0.06 m^3/s at the Town of Milk River). Only one other year registered a lower value (in 1922, where the discharge was 0.058 m^3/s; See Figure 3.9 in Section 3.2.1). In 2001, the headgates to the diversion canal closed in August instead of the normal closure in October. Thus there were extremely low water levels by late fall. At the Pinhorn Ranch area in October, the riverbed was dry in large sections, with isolated pools scattered throughout. Since this section of river did not have flowing water, it is assumed that the lower 45 km to the international border experienced similar (or worse) conditions.

Habitat degradation caused by agricultural activity could also affect the continued viability of species at risk (Houston 1998), primarily through instream disturbance, bank erosion, and non-point source surface runoff causing increased sediment levels. Trautman (1957) and Willock (1968) suggested that the loss of silvery minnow from extensive areas in the USA was attributed to excessive turbidity (suspended sediment) and the disappearance of aquatic vegetation due to heavy sediment deposition.

Recommendations

Recommendations for future studies include:

- Since there is much uncertainty as to the genetic status of the St. Mary sculpin (*Cottus sp.*), priority should be taken to analyze DNA samples collected in October 2001. Fifty samples were collected from fish in each the Milk River and St. Mary;

- Due to the extreme drought conditions observed in October 2001, a late winter/early spring study should be conducted to determine the extent of winter-kill in the isolated pools in the lower Milk River. *[**Note:** a late winter study was funded by the Department of Fisheries and Oceans and was conducted in March 2002. The report is presented in Appendix F.]*

- To continue to assess the status of the species of interest, future monitoring studies should be completed on a scheduled basis (i.e., every 3 years) using standardized methods (e.g., backpack electrofishing); sampling should occur during similar times of the year (e.g., fall) and be conducted in representative (index) sites. Given the severity of the winter of 2001/2002, a monitoring study should commence the fall of 2002.

- Of the five species of interest, more detailed studies on the distribution, abundance, and habitat preferences of the western silvery and brassy minnows are required (i.e., due to their limited distribution).

6.0 LITERATURE CITED

Brown, C.J.D.1971. Fishes of Montana. Big Sky Books, Mont. State Univ., Bozeman. 207 p.

Clayton, T.B. and G.R. Ash. 1980. A fisheries overview study of the Milk River Basin. Prepared for Alberta Environment, Planning Division, Edmonton, Alberta. 93 p. + App.

Gasser, K.W., D.A. Cannamela, and D.W. Johnson. 1981. Contributions to the Life History of the Shorthead Sculpin, *Cottus confusus*, in the Big Lost River, Idaho: age, growth, and fecundity. Northwest Science. 5(3): 174-181.

Henderson, N.E. and R.E. Peter. 1969. Distribution of fishes of southern Alberta. J. Fish. Res. Board Can. 26:325-338.

Houston, J. 1998. Status of the Western Silvery Minnow, *Hybognathus argyritis*, in Canada. Canadian Field-Naturalist 122(1):147-153.

Hughes, G.W. and A.E. Peden. 1984. Life history and status of the shorthead sculpin (*Cottus confuses*: Pisces, Cottidae) in Canada and the sympatric relationship to the slimy sculpin (*Cottus cognatus*). Can. J. Zool. 62: 306-311.

Jones, P.W., F.D. Martin, and J.D. Hardy, Jr. 1978. Development of fishes of the mid-Atlantic Bight. Vol. 1. Acipenseridae through Ictaluridae. Proj. FWS/OBS – 78/12, Fish Wildl. Serv., U.S. Dep. Inter., Washington, D.C. 366 p.

Nelson, J.S. and M.J. Paetz. 1992. The fishes of Alberta. The University of Alberta Press, Edmonton, Alberta. 437 p.

Noton, L. 1980. Milk River Basin environmental overview – surface water quality overview and assessment. Vol. 1. Main Report. Report prepared for Alberta Environment by Chemical and Geological Laboratory Ltd. 82 p.

O'Neil, J. and L. Hildebrand. 1986. Fisheries resources upstream of the Oldman River Dam. Prepared for Alberta Environment, Planning Division, Edmonton, Alberta. 131 p. + App.

Paetz, M.J. 1993. A management plan for the St. Mary St. Mary sculpin (*Cottus sp.*) in Alberta. Prepared for World Wildlife Fund Canada - Prairie for Tomorrow and Alberta Fish and Wildlife Division. 1993.

Peden, A.E. and G. W. Hughes. 1984. Status of the St. Mary sculpin, *Cottus confusus*, in the Flathead River, British Columbia. Canadian Field-Naturalist 98(1):127-133.

Raney, E.C. 1939. The breeding habits of the silvery minnow, *Hybognathus regius* Girard. American Midland Naturalist 21: 674-680.

RL&L Environmental Services Ltd. 2001. Fish species at risk in the Milk and St. Mary drainages. Report prepared for Alberta Environment. Natural Resources Service – Prairie Region. RL&L Report No. 862F: 53 p. + 5 App.

RL&L Environmental Services Ltd. 1986. Late winter fisheries study - Milk River Site 2 Dam. Prepared for Alberta Environment, Planning Division, Edmonton, Alberta. 29 p. + App.

RL&L Environmental Services Ltd. 1987. An inventory of aquatic habitats and fish resources in the Milk River, Alberta. Prepared for Alberta Environment, Planning Division, Edmonton, Alberta. 80 p. + App.

Roberts, W.E. 1988. The sculpins of Alberta. Alberta Nat. 18(4):121-127:153.

Scott W.B. and E.J. Crossman. 1973.Freshwater fishes of Canada. Fish. Res. Board Can. Bull. 184. 966 p.

Stantec Consulting Ltd. 2000. Environmental Assessment of Highway 4 in the Vicinity of Milk River - Draft. Prepared for Alberta Infrastructure. Stantec Project Number 136-77312.

Trautman, M.B. 1957. Fishes of Ohio. Ohio State University Press, Columbus, Ohio. xviii+683 p.

Willock, T.A. 1968. New Alberta records of the silvery and brassy minnows, stonecat and sauger, with a preliminary list of fishes of the Milk River in Alberta. Canadian Field-Naturalist 82:18-23.

Willock, T.A. 1969. The ecology and zoogeography of fishes in the Missouri (Milk River) drainage of Alberta. M.Sc. Thesis. Carleton University, Ottawa, Ontario.

Personal Communication

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APPENDIX A
Site Data

Appendix A Table 1. Information for sites sampled in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site Label	Site No.	Zone	Easting	Northing
Lee Creek					
	D. Kiemele	17	12U	314479	5433476
	Town of Beazer	18	12U	318515	5442905
	Cardston's water intake	19	12U	329379	5448649
	Cardston	20	12U	332954	5452242
Lost River					
	Hwy 502 Bridge	1a	12U		
Milk River					
	Pinhorn Ranch	1	12U	509739	5441407
	Aden Bridge	2	12U	477843	5443424
	Writing-on-Stone Provincial Park	3	12U	455180	5436443
	Town of Milk River	4	12U	421050	5443726
	W. Snow	5	12U	412862	5445209
	Twin River Grazing Reserve	6	12U	388016	5431708
	P. Hilmer	7	12U	374268	5441279
	Hwy 62 Bridge	8	12U	370185	5439069
	F.Hoyt	9	12U	359500	5436424
	J. Hoyt	10	12U	356082	5431944
	Pinhorn Ranch	21	12U	506923	5439254
	J. Ross (Milk River Cattle Co.)	22	12U	485109	5444104
	Deer Creek Bridge	23	12U	460864	5437221
	Weir Bridge	24	12U	448815	5439142
	C. Netts	25	12U	437670	5439840
	Coffin Bridge	26	12U	435006	5439026
	J. Chapman	27	12U	431058	5438732
	Goldspring Park	28	12U	427624	5438579
	G. Pittman	29	12U	429419	5439455
St. Mary River					
	Rinehart Ranches	11	12U	332424	5432578
	Kimble Fairground	12	12U	337490	5439395
	Hwy 501 Bridge near Kimble	13	12U	337925	5439867
	W. Bust	14	12U	338358	5441658
	K. Jensen (Snake Creek Ranch)	15	12U	340093	5448552
	Hwy5 bridge at Cardston	16	12U	335077	5454858
	Kimble Fairgrounds to W. Bust	12 to 14	12U	337490	5439395

Appendix A Table 2. Information for sites sampled in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site Label	Site No.	Zone	Easting	Northing
Lee Creek					
	Cardston	20	12	332906	5452991
Milk River					
	Pinhorn Ranch	1	12	509533	5441055
	Writing On Stone	3	12	455176	5436429
	Town of Milk River	4	12	421083	5443755
	Foggin's	9	12	359712	5436466
	Pinhorn Ranch	21	12	507021	5441133
	Deer Creek Bridge	23	12	460858	5437180
	Coffin Bridge	26	12	435029	5439028
	Chapman's	27	12	431087	5438798
	Goldspring Park	28	12	427626	5438587
	Pinhorn Ranch	30	12	506225	5441015
	Pinhorn Ranch	31	12	508322	5441279
	Pinhorn Ranch	32	12	506465	5441355
	Pinhorn Ranch	33	12	505545	5441260
	Pinhorn Ranch	34	12	504528	5441615
	Pinhorn Ranch	35	12	504817	5441700
	Pinhorn Ranch	36	12	505954	5440945
	Pinhorn Ranch	37	12	502937	5441218
	Pinhorn Ranch	38	12	503281	5441501
	Pinhorn Ranch	39	12	503833	5441426
	Pinhorn Ranch	40	12	510735	5441248
	Pinhorn Ranch	41	12	512041	5441065
	Pinhorn Ranch	42	12	512384	5441189
	Pinhorn Ranch	43	12	510878	5441526
	Pinhorn Ranch	44	12	506846	5441370
	Pinhorn Ranch	45	12	506579	5441424
	Pinhorn Ranch	46	12	505607	5441326
	Pinhorn Ranch	47	12	506355	5441207
	Ross Ranch	48	12	485247	5444137
	Ross Ranch	49	12	485727	5444127
	Ross Ranch	50	12	488268	5442821
	Ross Ranch	51	12	487709	5442844
St. Mary River					
	Kimball Park	12	12	337592	5439472
	Jenson's	15	12	340076	5448349

APPENDIX B
Habitat Classification System

Stream Habitat Classification System (O'Neil and Hildebrand 1986).

A) **Riffle** - Portion of channel with increased velocity relative to Run and Pool habitat types; broken water surface due to effects of submerged or exposed bed materials; relatively shallow (less than 25 cm) during moderate to low flow periods.

Riffle (RF) - Typical riffle habitat type; limited submerged or overhead cover for juveniles and adult life stages; coarse substrate

Riffle-Boulder Garden (RF/BG) - Riffle habitat type with significant occurrence of large boulders; availability of significant instream cover for juveniles (to lesser extent adults) at moderate to high flow events.

B) **Rapids (RA)** - Portion of channel with highest velocity relative to other habitat types. Deeper than Riffle (ranging from 25-50 cm); often formed by channel constriction. Substrate extremely coarse; dominated by large cobble and boulder material. Instream cover provided in pocket eddies (P3) and associated with cobble/boulder substrate.

C) **Run** - Portion of channel characterized by moderate to high current velocity relative to Pool and Flat habitat; water surface largely unbroken. Deeper than Riffle habitat type. Can be differentiated into four types; deep-slow, deep-fast, shallow-slow, and shallow-fast.

Run (Class 1) (R1) - Highest quality Run habitat type. Maximum depth exceeding 1.5 m; average depth 1.0 m. High instream cover at all flow conditions (submerged boulders/bedrock fractures, depth). Generally of deep-slow type (to lesser extent deep-fast) and situated proximal to upstream food production area (i.e., RF, R3).

Run (Class 2) (R2) - Moderate quality Run habitat type. Maximum depth reaching or exceeding 1.0 m, generally exceeding 0.75 m. High instream cover during all but low flow events (baseflow). Generally of either deep-fast type or moderately deep-slow type.

Run (Class 2)/Boulder garden (R2/BG) - Moderate quality Run habitat type; presence of large boulders in channel; high instream cover (boulder, bedrock fractures, turbulence) at all but low-flow events (baseflow). Depth characteristics similar to R2; however, required maximum depth lower due to cover afforded by boulders.

Run (Class 3) (R3) - Lowest quality Run habitat type. Maximum depth of 0.75 m, but averaging <0.50 m. Low instream cover at all but high flow events. Generally of shallow-fast or shallow-slow types.

Run (Class 3)/Boulder garden (R3/BG) - Similar to R3 in depth and velocity characteristics; presence of large boulders in channel offers improved instream cover during moderate and high flow events.

D) **Flat (FL)** - Area of channel characterized by low current velocities (relative to RF and Run cover types); near-laminar (i.e., non-turbulent) flow character. Depositional area featuring predominantly sand/silt substrate. Differentiated from Pool habitat type on basis of high channel uniformity and lack of direct riffle/run association. More depositional in nature than R3 habitat (sand/silt substrate, lower food production, low cover, etc.).

Flat (Class 1) (F1) - High quality Flat habitat type. Maximum depth exceeding 1.5 m; average depth 1.0 m or greater.

Flat (Class 2) (F2) - Moderate quality Flat habitat type. Maximum depth exceeding 1.0 m; generally exceeding 0.75 m.

Flat (Class 3) (F3) - Low quality Flat habitat type. Maximum depth of 0.75 m, averaging less than 0.50 m.

E) **Pool** - Discrete portion of channel featuring increased depth and reduced velocity (downstream oriented) relative to Riffle and Run habitat types.

Pool (Class 1) (P1) - Highest quality Pool habitat type. Maximum depth exceeding 1.5 m; average depth 1.0 m or greater; high instream cover at all flow-conditions (submerged boulder, bedrock fractures, depth, bank irregularities). Generally featuring high Riffle and/or Run association (i.e., food input). Often intergrades with deep-slow type of R1.

Pool (Class 2) (P2) - Moderate quality Pool habitat type. Maximum depth reaching or exceeding 1.0 m, generally exceeding 0.75 m. High instream cover at all but low flow events (baseflow).

Pool (Class 3) (P3) - Low quality pool habitat type. Maximum depth of 0.75 m, averaging <0.50 m. Low instream cover at all but high flow events. Includes small pocket eddy type habitat.

Citation:

O'Neil, J. and L. Hildebrand. 1986. Fishery resources upstream of the Oldman River Dam. Prepared for Alberta Environment, Planning Division. R.L&L. Report No. 181: 131 p. + 7 app.

APPENDIX C
Photo Documentation

Plate 1 **Milk River,** *October 2000.* Downstream view at Aden Bridge (Site 2).

Plate 2 **Milk River** *October 2000.* Downstream view at Coffin Bridge. Stonecat habitat at large boulder in the mid-section of the photo (Site 26)

Plate 3 **South Milk River,** *August 2000.* Dry channel near Twin River Grazing Reserve (Site 6).

Plate 4 **North Milk River,** *October 2000.* Upstream view at G. Foggin property immediately downstream of summer site (Site 9)

Plate 5 **St. Mary River,** *August 2000.* Downstream view of riffle habitat at Highway 501 bridge (Site 13).

Plate 7 **St. Mary River,** *October 2000.* Shorthead sculpin at Snake Creek Ranch (Site 15).

Plate 6 **Lee Creek,** *August 2000.* Upstream view at Redford Park in Cardston (Site 20).

Plate 8 **Milk River,** *October 2000.* Stonecat found near Coffin Bridge (Site 26).

Plate 9 **Milk River,** *20 July 2001.* Upstream view of Milk River from Pinhorn Ranch headquarters.

Plate 10 **Milk River,** *19 July 2001.* Milk River at Site 35 looking downstream. Note: shallow water depth in thalweg.

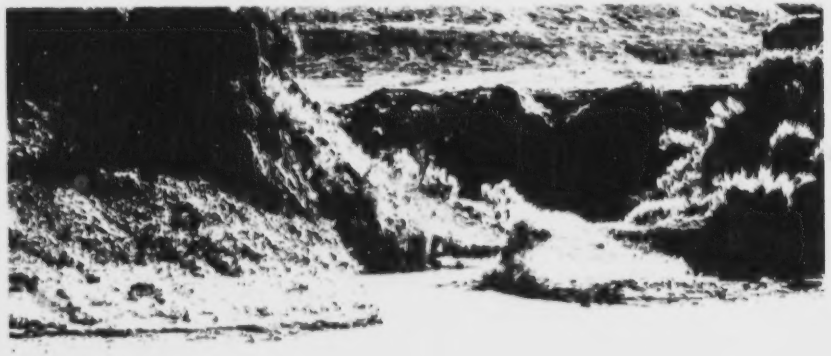


Plate 11 **Milk River,** 19 *July 2001.* Unnamed tributary coulee at Site 36. Three western silvery minnows were captured in the coulee.

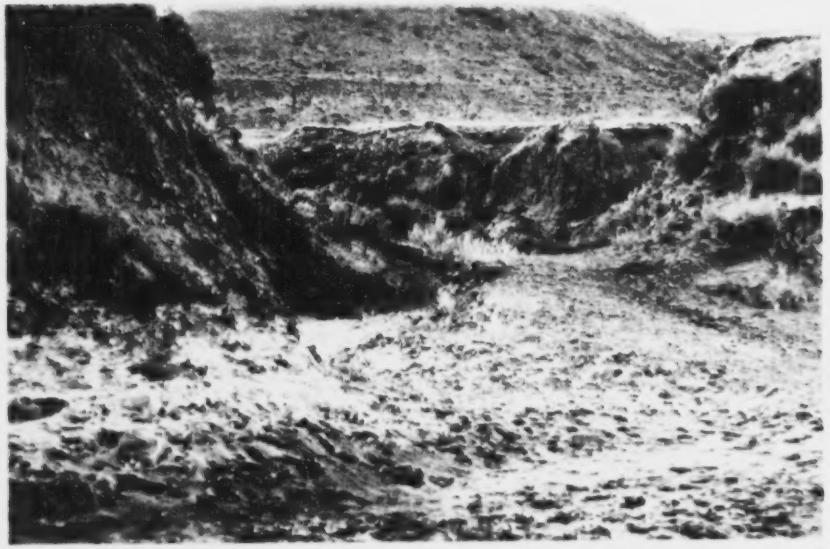


Plate 12 **Milk River,** *19 October 2001.* Same coulee as in Plate 3 but viewed during fall. Note: dry channel.

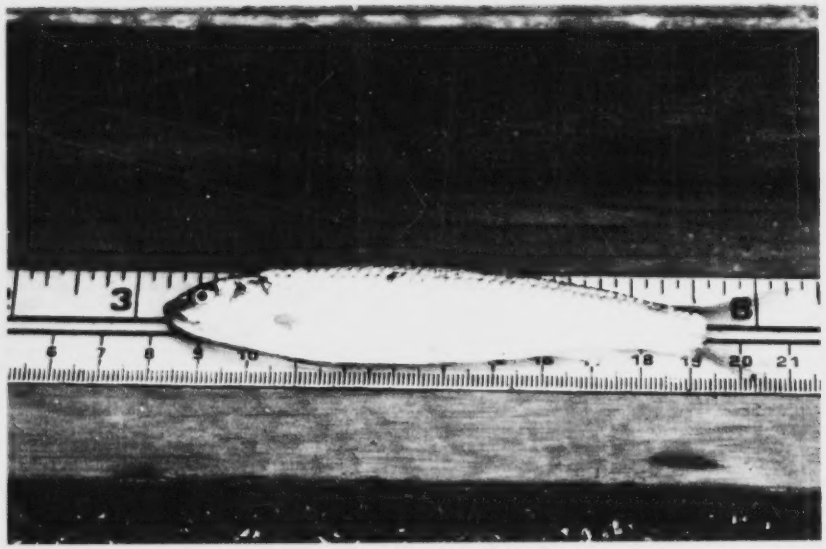


Plate 13 **Milk River,** *18 October 2001.* Western silvery minnow captured in isolated pools located near the Pinhorn Ranch.

Plate 14 **Milk River,** *19 October 2001.* Isolated pools near Pinhorn Ranch where sauger were captured.

Plate 15 **Milk River,** *18 October 2001.* Dry riverbed during fall downstream of the Pinhorn Ranch (Site 1).

Plate 16 **Milk River,** *20 October 2001.* View of Ross Ranch during fall sampling program. Note: dry river bed (near Site 22).

APPENDIX D
Fish Data

Appendix D Table 1. Fish species encountered in the Milk and St. Mary Rivers Study Area, 2000 and 2001.

Family	Common Name	Scientific Name	Code
Salmonidae			
	Cutthroat trout	*Oncorhynchus clarki*	CTTR
	Mountain whitefish	*Prosopium williamsoni*	MNWH
	Rainbow trout	*Oncorhynchus mykiss*	RNTR
Cyprinidae			
	Brassy minnow	*Hybognathus hankinsoni*	BRMN
	Flathead chub	*Platygobio gracilis*	FLCH
	Lake chub	*Couesius plumbeus*	LKCH
	Longnose dace	*Rhinichthys cataractae*	LNDC
	Western silvery minnow	*Hybognathus argyritis*	SLMN
Catostomidae			
	Longnose sucker	*Catostomus catostomus*	LNSC
	Mountain sucker	*Catostomus platyrhynchus*	MNSC
	Sucker species	*Catostomus sp.*	Suck sp
	White sucker	*Catostomus commersoni*	WHSC
Ictaluridae			
	Stonecat	*Noturus flavus*	STON
Gadidae			
	Burbot	*Lota lota*	BURB
Gasterosteidae			
	Brook stickleback	*Culaea inconstans*	BRST
Percopsidae			
	Trout perch	*Percopsis omiscomaycus*	TRPR
Percidae			
	Sauger	*Stizostedion canadense*	SAUG
Cottidae			
	St. Mary sculpin	*Cottus sp.*	SHSC

	Unidentified		UNID

Appendix D Table 2. Fish sampling methods and effort in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Sampling Date	Sampling Method	Pass No.	Electrofishing Effort (sec)	Seine Distance (m)
Lee Creek						
	17					
		13-Aug-00	Backpack Electrofishing	1	366	
	18					
		14-Aug-00	Backpack Electrofishing	1	492	
	19					
		14-Aug-00	Backpack Electrofishing	1	65	
	20					
		13-Aug-00	Backpack Electrofishing	1	368	
Milk River						
	1					
		08-Aug-00	Beach Seine	1		25
		08-Aug-00	Beach Seine	2		25
		08-Aug-00	Beach Seine	3		25
		08-Aug-00	Beach Seine	4		42
		08-Aug-00	Beach Seine	5		25
		08-Aug-00	Beach Seine	6		25
		08-Aug-00	Beach Seine	7		25
		21-Oct-00	Backpack Electrofishing	1	883	
		21-Oct-00	Beach Seine	1		25
		21-Oct-00	Beach Seine	2		25
		21-Oct-00	Beach Seine	3		25
	2					
		08-Aug-00	Backpack Electrofishing	1	210	
		08-Aug-00	Beach Seine	1		25
		08-Aug-00	Beach Seine	2		50
		08-Aug-00	Beach Seine	3		35
		22-Oct-00	Backpack Electrofishing	1	295	
		22-Oct-00	Beach Seine	1		25
		22-Oct-00	Beach Seine	2		25
		22-Oct-00	Beach Seine	3		25
	3					
		09-Aug-00	Backpack Electrofishing	1	202	
		09-Aug-00	Beach Seine	1		45
		09-Aug-00	Beach Seine	2		60
		09-Aug-00	Beach Seine	3		48
		20-Oct-00	Backpack Electrofishing	1	684	
		20-Oct-00	Beach Seine	1		25
		20-Oct-00	Beach Seine	2		25
		20-Oct-00	Beach Seine	3		25
	4					
		09-Aug-00	Backpack Electrofishing	1	931	
		09-Aug-00	Boat Electrofish	1	217	

Appendix D Table 2. Fish sampling methods and effort in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Sampling Date	Sampling Method	Pass No.	Electrofishing Effort (sec)	Seine Distance (m)
Milk River						
	4					
		19-Oct-00	Backpack Electrofishing	1	526	
		19-Oct-00	Beach Seine	1		25
		19-Oct-00	Beach Seine	2		25
	5					
		10-Aug-00	Beach Seine	1		25
		10-Aug-00	Beach Seine	2		25
		10-Aug-00	Beach Seine	3		25
		10-Aug-00	Boat Electrofish	1	208	
		19-Oct-00	Backpack Electrofishing	1	383	
		19-Oct-00	Beach Seine	1		25
		19-Oct-00	Beach Seine	2		25
		19-Oct-00	Beach Seine	3		25
	7					
		10-Aug-00	Beach Seine	1		37
		10-Aug-00	Beach Seine	2		32
		10-Aug-00	Beach Seine	3		25
		10-Aug-00	Boat Electrofish	1	109	
		19-Oct-00	Backpack Electrofishing	1	518	
	8					
		11-Aug-00	Backpack Electrofishing	1	221	
		11-Aug-00	Backpack Electrofishing	2	233	
		11-Aug-00	Beach Seine	1		25
		11-Aug-00	Beach Seine	2		25
		19-Oct-00	Backpack Electrofishing	1	585	
	9					
		11-Aug-00	Backpack Electrofishing	1	273	
		11-Aug-00	Beach Seine	1		25
		11-Aug-00	Beach Seine	2		35
		18-Oct-00	Backpack Electrofishing	1	318	
	10					
		12-Aug-00	Backpack Electrofishing	1	435	
		18-Oct-00	Backpack Electrofishing	1	470	
	21					
		21-Oct-00	Beach Seine	1		30
		21-Oct-00	Beach Seine	2		25
		21-Oct-00	Beach Seine	3		25
	22					
		22-Oct-00	Beach Seine	1		25
		22-Oct-00	Beach Seine	2		25
		22-Oct-00	Beach Seine	3		25

Appendix D Table 2. Fish sampling methods and effort in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Sampling Date	Sampling Method	Pass No.	Electrofishing Effort (sec)	Seine Distance (m)
Milk River						
	23					
		22-Oct-00	Backpack Electrofishing	1	755	
	24					
		20-Oct-00	Backpack Electrofishing	1	371	
		20-Oct-00	Beach Seine	1		25
		20-Oct-00	Beach Seine	2		25
		20-Oct-00	Beach Seine	3		25
	25					
		23-Oct-00	Backpack Electrofishing	1	579	
	26					
		20-Oct-00	Backpack Electrofishing	1	645	
	27					
		22-Oct-00	Backpack Electrofishing	1	483	
	28					
		20-Oct-00	Backpack Electrofishing	1	376	
	29					
		23-Oct-00	Backpack Electrofishing	1	665	
St. Mary River						
	11					
		12-Aug-00	Backpack Electrofishing	1	421	
	12					
		12-Aug-00	Backpack Electrofishing	1	282	
		12-Aug-00	Beach Seine	1		25
		12-Aug-00	Beach Seine	2		25
		18-Oct-00	Backpack Electrofishing	1	432	
		18-Oct-00	Beach Seine	1		25
		18-Oct-00	Beach Seine	2		25
	13					
		13-Aug-00	Backpack Electrofishing	1	253	
		13-Aug-00	Backpack Electrofishing	2	183	
	14					
		13-Aug-00	Backpack Electrofishing	1	377	
	15					
		14-Aug-00	Backpack Electrofishing	1	212	
		14-Aug-00	Backpack Electrofishing	2	135	
		14-Aug-00	Beach Seine	1		25
		18-Oct-00	Backpack Electrofishing	1	378	
	16					
		15-Aug-00	Backpack Electrofishing	1	293	
	12 to 14					
		15-Aug-00	Boat Electrofish	1	1289	

Appendix D Table 3. Fish sampling methods and effort in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Sampling Date	Sampling Method	Pass No.	Electrofishing Effort (sec)	Seine Distance (m)
Lee Creek						
	20					
		23-Oct-01	Backpack Electrofish	1	343	
Milk River						
	1					
		18-Oct-01	Backpack Electrofish	1	834	
	3					
		21-Oct-01	Backpack Electrofish	1	1011	
	4					
		22-Oct-01	Backpack Electrofish	1	792	
	9					
		23-Oct-01	Backpack Electrofish	1	343	
		23-Oct-01	Backpack Electrofish	1	499	
	21					
		19-Oct-01	Beach Seine	1		45
	23					
		21-Oct-01	Backpack Electrofish	2	387	
		21-Oct-01	Backpack Electrofish	1	417	
	26					
		21-Oct-01	Backpack Electrofish	1	773	
	27					
		22-Oct-01	Backpack Electrofish	1	586	
	28					
		22-Oct-01	Backpack Electrofish	1	944	
		22-Oct-01	Backpack Electrofish	2	917	
		22-Oct-01	Backpack Electrofish	3	566	
	30					
		18-Jul-01	Beach Seine	2		37
		18-Jul-01	Beach Seine	1		30
				1		
	31					
		18-Jul-01	Beach Seine	1		45
		18-Jul-01	Beach Seine	2		25
	32					
		19-Jul-01	Beach Seine	1		36
		19-Jul-01	Beach Seine	2		20
	33					
		19-Jul-01	Beach Seine	1		25
		19-Jul-01	Beach Seine	2		5
		19-Jul-01	Beach Seine	3		34
	34					
		19-Jul-01	Beach Seine	1		40

Appendix D Table 3. Fish sampling methods and effort in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Sampling Date	Sampling Method	Pass No.	Electrofishing Effort (sec)	Seine Distance (m)
Milk River						
	35					
		19-Jul-01	Beach Seine	1		60
	36					
		19-Jul-01	Beach Seine	1		15
		19-Oct-01	Backpack Electrofish	1	561	
	37					
		20-Jul-01	Beach Seine	2		15
		20-Jul-01	Beach Seine	1		35
	38					
		20-Jul-01	Beach Seine	1		50
	39					
		20-Jul-01	Beach Seine	2		30
		20-Jul-01	Beach Seine	1		40
	40					
		18-Oct-01	Backpack Electrofish	1	751	
	41					
		18-Oct-01	Backpack Electrofish	1	170	
	42					
		18-Oct-01	Backpack Electrofish	1	633	
	45					
		19-Oct-01	Backpack Electrofish	1	246	
	46					
		19-Oct-01	Beach Seine	1		60
	47					
		19-Oct-01	Beach Seine	1		25
	48					
		20-Oct-01	Backpack Electrofish	1	140	
	49					
		20-Oct-01	Beach Seine	1		25
	50					
		20-Oct-01	Beach Seine	1		13
	51					
		20-Oct-01	Beach Seine	1		14
St. Mary River						
	12					
		23-Oct-01	Backpack Electrofish	1	793	
		23-Oct-01	Backpack Electrofish	2	177	
	15					
		23-Oct-01	Backpack Electrofish	1	692	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Lee Creek						
	19					
		14-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	36	
				Shorthead sculpin	64	4
				Shorthead sculpin	68	4
				Shorthead sculpin	76	4
				Shorthead sculpin	35	
				Shorthead sculpin	39	
				Shorthead sculpin	33	
				Shorthead sculpin	31	
				Shorthead sculpin	34	
				Shorthead sculpin	26	
				Shorthead sculpin	37	
				Shorthead sculpin	33	
				Shorthead sculpin	36	
				Shorthead sculpin	31	
				Shorthead sculpin	37	
				Shorthead sculpin	29	
				Shorthead sculpin	35	
				Shorthead sculpin	36	
	20					
		13-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	36	
				Shorthead sculpin	43	
				Shorthead sculpin	41	
				Shorthead sculpin	39	
				Shorthead sculpin	41	
				Shorthead sculpin	39	
				Shorthead sculpin	37	
				Shorthead sculpin	39	
				Shorthead sculpin	40	
				Shorthead sculpin	40	
				Shorthead sculpin	38	
Milk River						
	1					
		08-Aug-00				
			Beach Seine			
				Sauger	343	284
		21-Oct-00				
			Backpack Electrofishing			
				Stonecat	267	172
				Stonecat	269	158
				Stonecat	248	160

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	1					
		21-Oct-00				
			Backpack Electrofishing			
				Stonecat	200	52
	2					
		22-Oct-00				
			Backpack Electrofishing			
				Sauger	458	
				Sauger	390	
				Sauger	345	
				Sauger	355	
				Sauger	375	
	3					
		20-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	56	
				Shorthead sculpin	61	
				Shorthead sculpin	56	
				Shorthead sculpin	63	
				Shorthead sculpin	64	
				Shorthead sculpin	57	
				Shorthead sculpin	83	
				Shorthead sculpin	49	
				Stonecat	32	
				Stonecat	85	
				Stonecat	146	
			Beach Seine			
				Shorthead sculpin	58	
				Shorthead sculpin	62	
	4					
		09-Aug-00				
			Backpack Electrofishing			
				Brassy minnow	48	
				Shorthead sculpin	30	
				Shorthead sculpin	36	
				Shorthead sculpin	34	
				Shorthead sculpin	32	
		19-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	52	
				Shorthead sculpin	103	12
				Shorthead sculpin	53	
				Shorthead sculpin	47	
				Shorthead sculpin	87	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	4					
		19-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	52	
				Shorthead sculpin	51	
				Shorthead sculpin	50	
				Shorthead sculpin	49	
				Shorthead sculpin	50	
				Shorthead sculpin	112	20
			Beach Seine			
				Shorthead sculpin	51	
				Shorthead sculpin	48	
				Shorthead sculpin	42	
				Shorthead sculpin	57	
				Shorthead sculpin	54	
				Shorthead sculpin	89	
				Shorthead sculpin	46	
				Shorthead sculpin	57	
				Shorthead sculpin	56	
				Shorthead sculpin	54	
	5					
		19-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	41	
				Shorthead sculpin	76	
				Shorthead sculpin	79	
				Shorthead sculpin	70	
				Shorthead sculpin	95	
				Shorthead sculpin	47	
				Shorthead sculpin	71	
				Shorthead sculpin	46	
				Shorthead sculpin	48	
				Shorthead sculpin	48	
				Shorthead sculpin	45	
				Shorthead sculpin	45	
				Shorthead sculpin	47	
			Beach Seine			
				Shorthead sculpin	49	
				Shorthead sculpin	47	
	7					
		10-Aug-00				
			Beach Seine			
				Shorthead sculpin	62	2

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	7					
		19-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	96	
				Shorthead sculpin	62	
				Shorthead sculpin	67	
				Shorthead sculpin	61	
				Shorthead sculpin	62	
				Shorthead sculpin	61	
				Shorthead sculpin	81	
				Shorthead sculpin	39	
				Shorthead sculpin	76	
				Shorthead sculpin	51	
				Shorthead sculpin	76	
				Shorthead sculpin	62	
				Shorthead sculpin	61	
				Shorthead sculpin	66	
				Shorthead sculpin	53	
				Shorthead sculpin	35	
				Shorthead sculpin	33	
				Shorthead sculpin	42	
				Shorthead sculpin	63	
				Shorthead sculpin	71	
				Shorthead sculpin	62	
				Shorthead sculpin	59	
				Shorthead sculpin	60	
				Shorthead sculpin	61	
				Shorthead sculpin	30	
				Shorthead sculpin	91	
	8					
		11-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	20	
				Shorthead sculpin	22	
				Shorthead sculpin	65	
				Shorthead sculpin	61	
				Shorthead sculpin	30	
				Shorthead sculpin	27	
				Shorthead sculpin	29	
			Beach Seine			
				Shorthead sculpin	27	
				Shorthead sculpin	28	
				Shorthead sculpin	34	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	8					
		19-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	61	
				Shorthead sculpin	60	
				Shorthead sculpin	55	
				Shorthead sculpin	40	
				Shorthead sculpin	36	
				Shorthead sculpin	41	
				Shorthead sculpin	60	
				Shorthead sculpin	61	
				Shorthead sculpin	57	
				Shorthead sculpin	36	
				Shorthead sculpin	69	
				Shorthead sculpin	75	
				Shorthead sculpin	59	
				Shorthead sculpin	63	
				Shorthead sculpin	50	
				Shorthead sculpin	66	
				Shorthead sculpin	62	
				Shorthead sculpin	66	
				Shorthead sculpin	56	
				Shorthead sculpin	80	
				Shorthead sculpin	69	
	9					
		11-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	23	
				Shorthead sculpin	66	
				Shorthead sculpin	19	
				Shorthead sculpin	32	
			Beach Seine			
				Shorthead sculpin	32	
				Shorthead sculpin	27	
				Shorthead sculpin	24	
				Shorthead sculpin	23	
				Shorthead sculpin	26	
				Shorthead sculpin	47	
				Shorthead sculpin	21	
		18-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	34	
				Shorthead sculpin	40	
				Shorthead sculpin	51	
				Shorthead sculpin	46	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	9					
		18-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	57	
				Shorthead sculpin	55	
				Shorthead sculpin	50	
				Shorthead sculpin	69	
				Shorthead sculpin	39	
				Shorthead sculpin	39	
				Shorthead sculpin	42	
				Shorthead sculpin	47	
				Shorthead sculpin	55	
				Shorthead sculpin	37	
				Shorthead sculpin	42	
				Shorthead sculpin	36	
				Shorthead sculpin	40	
				Shorthead sculpin	41	
				Shorthead sculpin	37	
				Shorthead sculpin	29	
				Shorthead sculpin	70	
				Shorthead sculpin	45	
				Shorthead sculpin	60	
				Shorthead sculpin	50	
				Shorthead sculpin	37	
				Shorthead sculpin	63	
				Shorthead sculpin	39	
				Shorthead sculpin	62	
				Shorthead sculpin	68	
				Shorthead sculpin	66	
				Shorthead sculpin	37	
				Shorthead sculpin	52	
				Shorthead sculpin	44	
				Shorthead sculpin	41	
				Shorthead sculpin	64	
				Shorthead sculpin	62	
				Shorthead sculpin	76	
				Shorthead sculpin	63	
				Shorthead sculpin	64	
	10					
		12-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	51	
				Shorthead sculpin	21	
				Shorthead sculpin	50	
				Shorthead sculpin	23	
				Shorthead sculpin	23	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	10					
		18-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	66	
				Shorthead sculpin	34	
				Shorthead sculpin	81	
				Shorthead sculpin	70	
				Shorthead sculpin	53	
				Shorthead sculpin	55	
				Shorthead sculpin	74	
				Shorthead sculpin	35	
				Shorthead sculpin	37	
				Shorthead sculpin	60	
				Shorthead sculpin	61	
				Shorthead sculpin	51	
				Shorthead sculpin	71	
				Shorthead sculpin	51	
				Shorthead sculpin	102	
				Shorthead sculpin	52	
				Shorthead sculpin	76	
				Shorthead sculpin	85	
				Shorthead sculpin	80	
				Shorthead sculpin	39	
				Shorthead sculpin	59	
				Shorthead sculpin	59	
				Shorthead sculpin	71	
				Shorthead sculpin	56	
				Shorthead sculpin	35	
				Shorthead sculpin	61	
				Shorthead sculpin	36	
				Shorthead sculpin	80	
				Shorthead sculpin	52	
	21					
		21-Oct-00				
			Beach Seine			
				Western silvery minn	44	
				Western silvery minn	38	
	22					
		22-Oct-00				
			Beach Seine			
				Brassy minnow	28	
				Brassy minnow	27	
				Brassy minnow	29	
				Brassy minnow	23	
				Brassy minnow	24	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	22					
		22-Oct-00				
			Beach Seine			
				Brassy minnow	29	
				Brassy minnow	27	
				Brassy minnow	24	
	23					
		22-Oct-00				
			Backpack Electrofishing			
				Sauger	405	
				Shorthead sculpin	66	
				Shorthead sculpin	76	8
				Stonecat	107	8
				Stonecat	112	16
				Stonecat	117	18
				Stonecat	143	30
				Stonecat	46	
				Stonecat	180	54
	24					
		20-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	63	
				Shorthead sculpin	51	
				Shorthead sculpin	60	
				Shorthead sculpin	56	
	26					
		20-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	55	
				Shorthead sculpin	52	
				Shorthead sculpin	56	
				Shorthead sculpin	47	
				Shorthead sculpin	59	
				Shorthead sculpin	51	
				Stonecat	143	26
				Stonecat	187	60
	27					
		22-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	59	
				Shorthead sculpin	51	
				Shorthead sculpin	52	
				Shorthead sculpin	108	18
				Shorthead sculpin	97	10

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	27					
		22-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	96	12
				Shorthead sculpin	81	8
				Shorthead sculpin	85	8
				Stonecat	82	4
				Stonecat	97	8
				Stonecat	131	22
				Stonecat	93	8
				Stonecat	107	12
				Stonecat	104	10
				Stonecat	108	10
				Stonecat	74	2
				Stonecat	97	10
	28					
		20-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	87	8
				Shorthead sculpin	52	
				Shorthead sculpin	114	20
				Shorthead sculpin	95	10
				Shorthead sculpin	98	10
				Shorthead sculpin	95	10
				Shorthead sculpin	80	6
				Shorthead sculpin	60	
				Shorthead sculpin	86	6
				Shorthead sculpin	56	
				Shorthead sculpin	46	
				Shorthead sculpin	46	
	29					
		23-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	52	
				Shorthead sculpin	53	
				Shorthead sculpin	91	10
				Shorthead sculpin	98	14
				Shorthead sculpin	81	8
				Shorthead sculpin	55	
				Shorthead sculpin	54	
				Shorthead sculpin	85	6
				Shorthead sculpin	82	8
				Shorthead sculpin	51	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	11					
		12-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	25	
				Shorthead sculpin	27	
				Shorthead sculpin	28	
				Shorthead sculpin	29	
				Shorthead sculpin	45	
				Shorthead sculpin	70	
				Shorthead sculpin	19	
				Shorthead sculpin	53	
				Shorthead sculpin	65	
				Shorthead sculpin	27	
	12					
		12-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	51	
				Shorthead sculpin	75	6
				Shorthead sculpin	69	4
				Shorthead sculpin	70	4
				Shorthead sculpin	76	6
				Shorthead sculpin	63	
		18-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	29	
				Shorthead sculpin	32	
				Shorthead sculpin	52	
				Shorthead sculpin	31	
				Shorthead sculpin	31	
				Shorthead sculpin	30	
				Shorthead sculpin	31	
				Shorthead sculpin	39	
				Shorthead sculpin	31	
				Shorthead sculpin	30	
				Shorthead sculpin	53	
				Shorthead sculpin	54	
				Shorthead sculpin	52	
				Shorthead sculpin	31	
				Shorthead sculpin	54	
				Shorthead sculpin	74	
				Shorthead sculpin	35	
				Shorthead sculpin	59	
				Shorthead sculpin	75	
				Shorthead sculpin	54	
				Shorthead sculpin	69	
				Shorthead sculpin	77	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	12					
		18-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	66	
				Shorthead sculpin	56	
				Shorthead sculpin	54	
				Shorthead sculpin	65	
				Shorthead sculpin	64	
				Shorthead sculpin	65	
				Shorthead sculpin	58	
			Beach Seine			
				Shorthead sculpin	60	
	13					
		13-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	64	
				Shorthead sculpin	63	
				Shorthead sculpin	49	
				Shorthead sculpin	26	
				Shorthead sculpin	66	2
				Shorthead sculpin		
				Shorthead sculpin	53	
				Shorthead sculpin	64	
				Shorthead sculpin	65	
				Shorthead sculpin	74	6
				Shorthead sculpin	59	
				Shorthead sculpin	48	
				Shorthead sculpin	76	4
				Shorthead sculpin	99	14
				Shorthead sculpin	89	6
				Shorthead sculpin	64	2
				Shorthead sculpin	59	
				Shorthead sculpin	58	
				Shorthead sculpin	24	
				Shorthead sculpin	23	
				Shorthead sculpin	52	
				Shorthead sculpin	69	2
				Shorthead sculpin	54	
				Shorthead sculpin	57	
				Shorthead sculpin	63	
				Shorthead sculpin	51	
				Shorthead sculpin	50	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	14					
		13-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	28	
				Shorthead sculpin	22	
				Shorthead sculpin	26	
	15					
		14-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	59	
				Shorthead sculpin	77	4
				Shorthead sculpin	89	8
				Shorthead sculpin	30	
				Shorthead sculpin	30	
		18-Oct-00				
			Backpack Electrofishing			
				Shorthead sculpin	41	
				Shorthead sculpin	35	
				Shorthead sculpin	41	
				Shorthead sculpin	74	2
				Shorthead sculpin	73	2
				Shorthead sculpin	83	6
				Shorthead sculpin	90	6
				Shorthead sculpin	31	
				Shorthead sculpin	45	
				Shorthead sculpin	46	
				Shorthead sculpin	43	
				Shorthead sculpin	60	
				Shorthead sculpin	71	2
				Shorthead sculpin	61	
				Shorthead sculpin	57	
				Shorthead sculpin	57	
				Shorthead sculpin	86	8
				Shorthead sculpin	66	
				Shorthead sculpin	31	
	16					
		15-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	38	
				Shorthead sculpin	39	
				Shorthead sculpin	37	
				Shorthead sculpin	35	
				Shorthead sculpin	34	
				Shorthead sculpin	43	
				Shorthead sculpin	27	

Appendix D Table 4. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	16					
		15-Aug-00				
			Backpack Electrofishing			
				Shorthead sculpin	34	
				Shorthead sculpin	37	
				Shorthead sculpin	39	
				Shorthead sculpin	38	
				Shorthead sculpin	40	
				Shorthead sculpin	40	
				Shorthead sculpin	32	
				Shorthead sculpin	85	
				Shorthead sculpin	39	
				Shorthead sculpin	31	
				Shorthead sculpin	36	
	12 to 14					
		15-Aug-00				
			Boat Electrofishing			
				Shorthead sculpin	61	

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Lee Creek						
	20					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	77	
				St. Mary sculpin	60	
				St. Mary sculpin	66	
				St. Mary sculpin	76	
				St. Mary sculpin	71	
				St. Mary sculpin	78	
				St. Mary sculpin	79	
				St. Mary sculpin	74	
				St. Mary sculpin	90	
				St. Mary sculpin	75	
				St. Mary sculpin	70	
				St. Mary sculpin	85	
				St. Mary sculpin	86	
				St. Mary sculpin	61	
Milk River						
	1					
		18-Oct-01				
			Backpack Electrofish			
				Sauger	125	
				Sauger	100	
				Sauger	99	
				Sauger	96	
				Sauger	127	
				Sauger	88	
				Sauger	101	
				Sauger	101	
				Sauger	132	
				Sauger	91	
				Sauger	124	
	3					
		21-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	64	4
				St. Mary sculpin	60	
				St. Mary sculpin	90	10
				Stonecat	225	112

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	4					
		22-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	102	18
				St. Mary sculpin	87	8
				St. Mary sculpin	91	8
				St. Mary sculpin	96	14
				St. Mary sculpin	92	14
				St. Mary sculpin	95	6
				St. Mary sculpin	82	4
				St. Mary sculpin	55	
				St. Mary sculpin	65	
				St. Mary sculpin	65	
				St. Mary sculpin	69	2
				Stonecat	217	110
	9					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	33	
				St. Mary sculpin	36	
				St. Mary sculpin	38	
				St. Mary sculpin	54	
				St. Mary sculpin	47	
				St. Mary sculpin	58	
				St. Mary sculpin	69	
				St. Mary sculpin	61	
				St. Mary sculpin	95	
				St. Mary sculpin	39	
				St. Mary sculpin	71	
				St. Mary sculpin	59	
				St. Mary sculpin	56	
				St. Mary sculpin	57	
				St. Mary sculpin	61	
				St. Mary sculpin	88	
				St. Mary sculpin	68	
				St. Mary sculpin	52	
				St. Mary sculpin	59	
				St. Mary sculpin	56	
				St. Mary sculpin	67	
				St. Mary sculpin	53	
				St. Mary sculpin	67	
				St. Mary sculpin	70	
				St. Mary sculpin	60	

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	9					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	70	
				St. Mary sculpin	64	
	21					
		19-Oct-01				
			Beach Seine			
				Sauger	101	8
				Sauger	93	4
				Sauger	127	12
				Sauger	109	10
				Sauger	90	6
				Sauger	83	
				Sauger	172	42
				Sauger	120	14
				Sauger	174	48
				Sauger	102	4
				Western silvery minnow	90	4
				Western silvery minnow	112	18
				Western silvery minnow	96	12
				Western silvery minnow	120	12
				Western silvery minnow	106	10
				Western silvery minnow	82	2
				Western silvery minnow	96	4
				Western silvery minnow	108	16
				Western silvery minnow	101	12
				Western silvery minnow	119	20
				Western silvery minnow	125	20
				Western silvery minnow	102	8
				Western silvery minnow	96	8
	26					
		21-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	88	8
				St. Mary sculpin	78	6
				St. Mary sculpin	80	6
				St. Mary sculpin	81	8
				St. Mary sculpin	76	4
				St. Mary sculpin	94	12
				Stonecat	136	22

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	27					
		22-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	90	10
				St. Mary sculpin	62	
				St. Mary sculpin	77	4
				St. Mary sculpin	76	4
				St. Mary sculpin	80	4
				St. Mary sculpin	86	6
				St. Mary sculpin	84	8
				St. Mary sculpin	110	18
				St. Mary sculpin	86	8
				St. Mary sculpin	90	10
				St. Mary sculpin	105	18
				St. Mary sculpin	59	
				St. Mary sculpin	59	
				St. Mary sculpin	85	8
				St. Mary sculpin	54	
				St. Mary sculpin	58	
				St. Mary sculpin	58	
				Stonecat	80	2
				Stonecat	128	24
				Stonecat	130	22
				Stonecat	152	40
				Stonecat	186	58
				Stonecat	80	4
				Stonecat	140	26
				Stonecat	141	24
				Stonecat	138	26
				Stonecat	166	32
				Stonecat	200	76
				Stonecat	137	26
				Stonecat	135	22
				Stonecat	151	32
				Stonecat	149	34
	28					
		22-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	66	
				St. Mary sculpin	59	
				St. Mary sculpin	107	20
				St. Mary sculpin	92	8
				St. Mary sculpin	92	10

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	28					
		22-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	90	8
				St. Mary sculpin	85	8
				St. Mary sculpin	84	8
				St. Mary sculpin	76	8
				St. Mary sculpin	103	16
				St. Mary sculpin	94	12
				St. Mary sculpin	78	8
				St. Mary sculpin	94	10
				St. Mary sculpin	87	12
				St. Mary sculpin	85	8
				St. Mary sculpin	90	8
				St. Mary sculpin	95	10
				St. Mary sculpin	90	10
				St. Mary sculpin	94	10
				St. Mary sculpin	62	
				St. Mary sculpin	85	6
				St. Mary sculpin	84	8
				St. Mary sculpin	77	4
				St. Mary sculpin	62	
				St. Mary sculpin	62	
				St. Mary sculpin	64	
				St. Mary sculpin	89	10
				St. Mary sculpin	53	
				St. Mary sculpin	86	8
				St. Mary sculpin	79	
				Stonecat	129	22
				Stonecat	145	28
				Stonecat	131	18
	31					
		18-Jul-01				
			Beach Seine			
				Sauger	78	
				Sauger	77	
				Sauger	76	
	36					
		19-Jul-01				
			Beach Seine			
				Sauger	76	
				Western silvery minnow	42	

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	36					
		19-Jul-01				
			Beach Seine			
				Western silvery minnow	38	
				Western silvery minnow	42	
		19-Oct-01				
			Backpack Electrofish			
				Sauger	105	
				Sauger	103	
				Sauger	106	
				Sauger	101	
				Sauger	86	
				Sauger	97	
				Western silvery minnow	44	
				Western silvery minnow	48	
	37					
		20-Jul-01				
			Beach Seine			
				Western silvery minnow	29	
	40					
		18-Oct-01				
			Backpack Electrofish			
				Sauger	427	714
				Sauger	97	
				Sauger	93	
				Sauger	558	1498
				Sauger	261	148
	41					
		18-Oct-01				
			Backpack Electrofish			
				Sauger	93	
				Sauger	94	
				Sauger	97	
				Sauger	102	
	42					
		18-Oct-01				
			Backpack Electrofish			
				Sauger	99	
				Sauger	127	
				Sauger	90	
				Sauger	120	

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	42					
		18-Oct-01				
			Backpack Electrofish			
				Sauger	88	
				Sauger	89	
				Sauger	92	
				Sauger	104	
				Sauger	104	
				Stonecat	199	92
				Stonecat	195	64
				Stonecat	178	62
				Stonecat	109	
	45					
		19-Oct-01				
			Backpack Electrofish			
				Sauger	100	4
				Stonecat	180	42
	46					
		19-Oct-01				
			Beach Seine			
				Sauger	88	
				Western silvery minnow	95	
	47					
		19-Oct-01				
			Beach Seine			
				Sauger	147	32
				Sauger	130	18
				Sauger	136	18
				Sauger	155	32
				Western silvery minnow	101	10
				Western silvery minnow	94	8
				Western silvery minnow	104	14
				Western silvery minnow	107	12
				Western silvery minnow	105	14
				Western silvery minnow	89	8
				Western silvery minnow	115	
				Western silvery minnow	113	16
				Western silvery minnow	120	20
				Western silvery minnow	140	34
				Western silvery minnow	114	16

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	49					
		20-Oct-01				
			Beach Seine			
				Western silvery minnow	104	
				Western silvery minnow	127	
				Western silvery minnow	128	
				Western silvery minnow	122	
				Western silvery minnow	120	
				Western silvery minnow	81	
	50					
		20-Oct-01				
			Beach Seine			
				Brassy minnow	35	
				Western silvery minnow	111	
	51					
		20-Oct-01				
			Beach Seine			
				St. Mary sculpin	64	
St. Mary River						
	12					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	81	
				St. Mary sculpin	62	
				St. Mary sculpin	50	
				St. Mary sculpin	31	
				St. Mary sculpin	51	
				St. Mary sculpin	48	
				St. Mary sculpin	68	
				St. Mary sculpin	57	
				St. Mary sculpin	61	
				St. Mary sculpin	81	
				St. Mary sculpin	62	
				St. Mary sculpin	79	
				St. Mary sculpin	66	
				St. Mary sculpin	72	
				St. Mary sculpin	62	
				St. Mary sculpin	78	
				St. Mary sculpin	55	
				St. Mary sculpin	76	
				St. Mary sculpin	41	

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	12					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	51	
				St. Mary sculpin	34	
	15					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	34	
				St. Mary sculpin	41	
				St. Mary sculpin	53	
				St. Mary sculpin	49	
				St. Mary sculpin	55	
				St. Mary sculpin	50	
				St. Mary sculpin	49	
				St. Mary sculpin	30	
				St. Mary sculpin	52	
				St. Mary sculpin	39	
				St. Mary sculpin	37	
				St. Mary sculpin	28	
				St. Mary sculpin	31	
				St. Mary sculpin	34	
				St. Mary sculpin	34	
				St. Mary sculpin	33	
				St. Mary sculpin	58	
				St. Mary sculpin	32	
				St. Mary sculpin	63	
				St. Mary sculpin	31	
				St. Mary sculpin	64	
				St. Mary sculpin	81	
				St. Mary sculpin	80	
				St. Mary sculpin	96	
				St. Mary sculpin	88	
				St. Mary sculpin	79	
				St. Mary sculpin	76	
				St. Mary sculpin	75	
				St. Mary sculpin	66	
				St. Mary sculpin	58	
				St. Mary sculpin	50	
				St. Mary sculpin	58	
				St. Mary sculpin	64	
				St. Mary sculpin	61	
				St. Mary sculpin	60	

Appendix D Table 5. Life history data for the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	15					
		23-Oct-01				
			Backpack Electrofish			
				St. Mary sculpin	57	
				St. Mary sculpin	55	
				St. Mary sculpin	59	
				St. Mary sculpin	58	
				St. Mary sculpin	59	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Lee Creek						
	17					
		13-Aug-00				
			Backpack Electrofishing			
				Cutthroat trout	118	20
				Longnose dace	66	
				Longnose dace	57	
				Longnose dace	48	
				Longnose dace	49	
				Longnose dace	54	
				Longnose dace	52	
				Longnose dace	53	
				Longnose dace	55	2
				Longnose dace	84	6
				Longnose dace	84	8
				Longnose dace	84	8
				Longnose dace	83	6
				Longnose dace	95	12
				Longnose dace		
				Mountain sucker	45	
				Mountain sucker	119	20
				Mountain sucker	70	4
				Rainbow trout	55	
	18					
		14-Aug-00				
			Backpack Electrofishing			
				Mountain sucker	108	14
				Mountain sucker	104	12
				Mountain sucker	101	14
				Mountain sucker	113	18
				Mountain sucker	91	8
				Mountain sucker	109	12
				Mountain sucker	114	16
				Mountain sucker	113	16
				Mountain sucker	101	14
				Mountain sucker	110	18
				Rainbow trout	55	
	19					
		14-Aug-00				
			Backpack Electrofishing			
				Lake chub	113	18
				Longnose dace	75	
				Longnose dace	74	
				Longnose dace	50	
				Longnose dace	54	
				Longnose dace	51	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Lee Creek						
	19					
		14-Aug-00				
			Backpack Electrofishing			
				Longnose dace	45	
				Longnose dace	65	
				Longnose dace	61	
				Longnose dace	48	
				Longnose dace	52	
				Mountain sucker	97	10
				Mountain sucker	99	12
				Mountain sucker	73	4
				Mountain sucker	87	6
				Mountain sucker	80	6
				Mountain sucker	102	14
	20					
		13-Aug-00				
			Backpack Electrofishing			
				Longnose dace	43	
				Longnose dace	38	
				Longnose dace	47	
				Longnose dace	54	
				Longnose dace	68	
				Longnose dace	44	
				Longnose dace	58	
				Longnose dace	52	
				Longnose dace	58	
				Longnose dace	67	
				Sucker species	27	
				White sucker	209	100
Milk River						
	1					
		08-Aug-00				
			Beach Seine			
				Flathead chub	22	
				Flathead chub	31	
				Flathead chub	90	
				Flathead chub	60	
				Flathead chub	25	
				Flathead chub	29	
				Flathead chub	28	
				Flathead chub	34	
				Flathead chub	19	
				Flathead chub	36	
				Flathead chub	102	
				Flathead chub	76	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	1					
		08-Aug-00				
			Beach Seine			
				Flathead chub	85	
				Flathead chub	75	
				Flathead chub	62	
				Flathead chub	28	
				Flathead chub	30	
				Flathead chub	66	
				Longnose dace	36	
				Longnose dace	47	
				Longnose dace	53	
				Mountain sucker	60	
				Mountain sucker	63	
				Mountain sucker	49	
				Mountain sucker	52	
				Mountain sucker	62	
				None		
		21-Oct-00				
			Backpack Electrofishing			
				Burbot	545	
			Beach Seine			
				None		
	2					
		08-Aug-00				
			Backpack Electrofishing			
				Flathead chub	57	
				Flathead chub	52	
				Flathead chub	49	
				Flathead chub	95	
				Flathead chub	86	
				Flathead chub	84	
			Beach Seine			
				Flathead chub	24	
				Flathead chub	21	
				Flathead chub	59	
				Flathead chub	53	
				Flathead chub	62	
				Flathead chub	62	
				Longnose sucker	34	
				Longnose sucker	40	
				Longnose sucker	38	
				Longnose sucker	32	
				Mountain sucker	39	
				Mountain sucker	35	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	2					
		08-Aug-00				
			Beach Seine			
				Sucker species	25	
				Sucker species	25	
				Sucker species	16	
				Sucker species	25	
				Sucker species	12	
				Sucker species	22	
				Sucker species	21	
				Sucker species	16	
				Sucker species	28	
				Sucker species	23	
				Sucker species	22	
				Sucker species	22	
				Sucker species	24	
				Sucker species	23	
				Sucker species	22	
				Sucker species	13	
				Sucker species	12	
		22-Oct-00				
			Backpack Electrofishing			
				Burbot	355	
				Burbot	510	
				Lake chub	98	
	3					
		09-Aug-00				
			Backpack Electrofishing			
				Longnose dace		
			Beach Seine			
				Burbot	20	
				Flathead chub	28	
				Flathead chub	110	
				Flathead chub	113	
				Flathead chub	34	
				Flathead chub	80	
				Flathead chub	65	
				Flathead chub	75	
				Flathead chub	92	
				Flathead chub	84	
				Flathead chub	67	
				Lake chub	77	
				Lake chub	83	
				Longnose sucker	100	
				Longnose sucker	43	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	3					
		09-Aug-00				
			Beach Seine			
				Longnose sucker	52	
				Longnose sucker	51	
				Longnose sucker	45	
				Longnose sucker	45	
				Longnose sucker	55	
				Longnose sucker	92	
				Longnose sucker	116	
				Longnose sucker	76	
		20-Oct-00				
			Beach Seine			
				Lake chub	29	
				Lake chub	28	
				Lake chub	34	
				Lake chub	37	
				Lake chub	32	
				Lake chub	24	
				Lake chub	27	
				Lake chub	35	
				Lake chub	31	
				Lake chub	33	
				Lake chub	34	
				Lake chub	38	
	4					
		09-Aug-00				
			Backpack Electrofishing			
				Flathead chub	87	
				Flathead chub	85	
				Longnose dace	23	
				Longnose dace	32	
				Longnose dace		
				Longnose dace		
				Longnose sucker	42	
				Longnose sucker	41	
				Mountain sucker	40	
				Mountain sucker	42	
		19-Oct-00				
			Backpack Electrofishing			
				Flathead chub	114	
				Flathead chub	146	
				Flathead chub	95	
				Flathead chub	94	
				Flathead chub	85	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	4					
		19-Oct-00				
			Backpack Electrofishing			
				Flathead chub	128	20
				Flathead chub	110	16
				Flathead chub	95	
				Flathead chub	150	32
				Flathead chub	89	
				Flathead chub	115	
				Flathead chub	100	
				Flathead chub	91	
				Lake chub	60	
				Longnose dace	38	
				Longnose dace	96	
				Longnose dace	49	
				Longnose dace	174	58
				Longnose dace	158	50
				Longnose dace	110	
				Longnose dace	118	
				Longnose dace	74	
				Longnose dace	115	
				Longnose dace	31	
				Longnose dace	60	
				Longnose dace	90	
				Longnose dace	26	
				Longnose dace	35	
				Longnose dace	102	
				Mountain sucker	60	
				Mountain sucker	69	
				Mountain sucker	80	
				Mountain sucker	55	
				Mountain sucker	64	
				Mountain sucker	69	
				Mountain sucker	64	
				Mountain sucker	65	
				Mountain sucker	74	
				Mountain sucker	61	
				Trout perch	70	
			Beach Seine			
				Unidentified	43	
	5					
		10-Aug-00				
			Boat Electrofishing			
				Flathead chub	171	
				Longnose sucker	345	
				White sucker	412	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	5					
		19-Oct-00				
			Backpack Electrofishing			
				Longnose dace	55	
	7					
		19-Oct-00				
			Backpack Electrofishing			
				Flathead chub	119	
				Lake chub	68	
				Lake chub	64	
				Lake chub	61	
				Longnose dace	62	
				Longnose dace	68	
				Longnose dace	34	
				Longnose dace	49	
				Mountain sucker	63	
				Mountain sucker	101	
				Mountain sucker	112	
	8					
		11-Aug-00				
			Backpack Electrofishing			
				Longnose dace	72	
			Beach Seine			
				Lake chub		
				Lake chub		
				Longnose dace	52	
				Longnose dace		
				Longnose sucker	64	
				Longnose sucker	50	
				Longnose sucker	71	
		19-Oct-00				
			Backpack Electrofishing			
				Longnose dace	55	
				Longnose dace	62	
				Mountain sucker	59	
	9					
		11-Aug-00				
			Beach Seine			
				Sucker species		
		18-Oct-00				
			Backpack Electrofishing			
				Longnose dace	30	
				Longnose dace	93	
				Mountain sucker	157	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	9					
		18-Oct-00				
			Backpack Electrofishing			
				White sucker	102	
	10					
		12-Aug-00				
			Backpack Electrofishing			
				Longnose dace	57	
				Longnose dace	69	
				Longnose dace	86	
				Longnose dace	62	
				Longnose dace	61	
				Longnose dace	74	
				Longnose dace	58	
		18-Oct-00				
			Backpack Electrofishing			
				Longnose dace	66	
				Longnose dace	76	
				Longnose dace	44	
				Longnose dace	89	
				Longnose dace	73	
				Longnose dace	71	
				Longnose dace	74	
				Longnose dace	31	
				Longnose dace	64	
				Longnose dace	64	
				Mountain sucker	114	
				Mountain whitefish	126	
	24					
		20-Oct-00				
			Backpack Electrofishing			
				Mountain sucker	126	
				Mountain sucker	106	
				White sucker	119	
	26					
		20-Oct-00				
			Backpack Electrofishing			
				Flathead chub	97	
				Flathead chub	81	
				Longnose dace	57	
				Longnose dace	39	
				Longnose dace	63	
				Longnose dace	65	
				Longnose dace	29	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	26					
		20-Oct-00				
			Backpack Electrofishing			
				Longnose dace	67	
				Longnose dace	51	
				Longnose dace	66	
				Longnose dace	59	
				Longnose dace	45	
				Longnose dace	67	
				Longnose dace	54	
				Longnose sucker	294	
				Mountain sucker	57	
				Mountain sucker	59	
				Mountain sucker	61	
				Sucker species	34	
	28					
		20-Oct-00				
			Backpack Electrofishing			
				Longnose dace	43	
				Longnose dace	35	
				Longnose dace	83	
				Longnose dace	64	
				Longnose dace	42	
				Mountain sucker	71	
	29					
		23-Oct-00				
			Backpack Electrofishing			
				Flathead chub	84	
				Flathead chub	120	
				Longnose dace	54	
				Longnose dace	82	
				Longnose dace	95	
St. Mary River						
	11					
		12-Aug-00				
			Backpack Electrofishing			
				Longnose dace	51	
				Longnose dace	54	
	12					
		12-Aug-00				
			Backpack Electrofishing			
				Longnose dace	65	
				Longnose dace	68	
				Longnose dace	64	

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	12					
		12-Aug-00				
			Beach Seine			
				Longnose dace	55	
				Longnose dace	56	
				Longnose dace		
				Longnose dace	50	
				Longnose dace	25	
				Longnose dace	49	
		18-Oct-00				
			Backpack Electrofishing			
				Longnose dace	63	
				Longnose dace	51	
				Longnose dace	66	
				Longnose dace	54	
				Longnose dace	79	
				Longnose dace	69	
				Longnose dace	51	
				Longnose dace	68	
			Beach Seine			
				Longnose dace	28	
				Longnose dace	29	
	13					
		13-Aug-00				
			Backpack Electrofishing			
				Longnose dace	68	
	14					
		13-Aug-00				
			Backpack Electrofishing			
				Longnose dace	61	
				Longnose dace	53	
				Longnose dace	62	
				Longnose dace	54	
				Longnose dace	55	
	15					
		14-Aug-00				
			Backpack Electrofishing			
				Longnose dace	53	
				Longnose dace	52	
				Longnose dace	21	
				Longnose dace	64	
				Longnose dace	62	
				Longnose dace	78	
				Longnose dace		

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	15					
		14-Aug-00				
			Backpack Electrofishing			
				Longnose dace	55	
				Trout perch	50	
				Trout perch	59	
		18-Oct-00				
			Backpack Electrofishing			
				Longnose dace	55	
				Longnose dace	31	
				Longnose dace	23	
				Longnose dace	29	
				Longnose dace	56	
				Longnose dace	45	
				Longnose dace	34	
				Mountain sucker	91	8
				Mountain sucker	52	
				Mountain sucker	76	6
				Sucker species	47	
				Sucker species	55	
				Sucker species	53	
				Sucker species	56	
				Trout perch	52	
				Trout perch	52	
				Trout perch	61	2
				Trout perch	81	8
				Trout perch	69	2
				White sucker	58	
				White sucker	72	4
	16					
		15-Aug-00				
			Backpack Electrofishing			
				Longnose dace	23	
				Longnose dace	35	
				Longnose dace	23	
				Longnose dace	28	
				Sucker species	27	
	12 to 14					
		15-Aug-00				
			Boat Electrofishing			
				Longnose sucker	144	35
				Longnose sucker	385	685
				Longnose sucker	447	955
				Longnose sucker	456	1100
				Mountain whitefish	178	70

Appendix D Table 6. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
St. Mary River						
	12 to 14					
		15-Aug-00				
			Boat Electrofishing			
				Mountain whitefish	412	785
				Mountain whitefish	135	25
				Mountain whitefish	211	90
				Mountain whitefish	168	45
				Mountain whitefish	351	500
				Mountain whitefish	198	95
				Mountain whitefish	236	125
				Mountain whitefish	230	120
				Mountain whitefish	180	50
				Mountain whitefish	242	145
				Mountain whitefish	147	40

Appendix D Table 7. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Lee Creek						
	20					
		23-Oct-01				
			Backpack Electrofish			
				Cutthroat trout	182	
				Mountain whitefish	93	
				Rainbow trout	190	
				Rainbow trout	197	
Milk River						
	26					
		21-Oct-01				
			Backpack Electrofish			
				Trout perch	51	
	28					
		22-Oct-01				
			Backpack Electrofish			
				Trout perch	65	
	30					
		18-Jul-01				
			Beach Seine			
				Flathead chub	49	
				Flathead chub	94	
				Flathead chub	43	
				Flathead chub	58	
				Flathead chub	52	
				Flathead chub	95	
				Flathead chub	101	
				Flathead chub	55	
				Flathead chub	97	
				Flathead chub	47	
	40					
		18-Oct-01				
			Backpack Electrofish			
				Flathead chub	106	
				Longnose dace	59	
				Longnose dace	63	
				Longnose dace	58	
				Longnose sucker	355	536
				Longnose sucker	318	388
				Longnose sucker	372	594
				White sucker	114	
				White sucker	105	

Appendix D Table 7. Life history data for fish species other than the Fish Species of Interest captured in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)
Milk River						
	41					
		18-Oct-01				
			Backpack Electrofish			
				Longnose sucker	120	
	42					
		18-Oct-01				
			Backpack Electrofish			
				Burbot	410	
				Longnose sucker	320	
				Longnose sucker	360	
	48					
		20-Oct-01				
			Backpack Electrofish			
				Lake chub	45	
	49					
		20-Oct-01				
			Beach Seine			
				Trout perch	53	
				Trout perch	40	
				Trout perch	46	
				Trout perch	61	
				Trout perch	44	
				Trout perch	50	
				Trout perch	57	
	50					
		20-Oct-01				
			Beach Seine			
				Brook stickleback	57	
St. Mary River						
	12					
		23-Oct-01				
			Backpack Electrofish			
				Mountain whitefish	101	
				Trout perch	83	

Appendix D Table 8. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
St. Mary River					
	13				
		13-Aug-00			
			Backpack Electrofishing		
				Shorthead sculpin	3
	16				
		15-Aug-00			
			Backpack Electrofishing		
				Longnose dace	2
	15				
		14-Aug-00			
			Backpack Electrofishing		
				Longnose dace	3
				Shorthead sculpin	1
				Trout perch	1
				Unidentified	1
			Beach Seine		
				Shorthead sculpin	1
		18-Oct-00			
			Backpack Electrofishing		
				Longnose dace	4
				Longnose dace	4
				Shorthead sculpin	3
				Sucker species	10
	12				
		12-Aug-00			
			Backpack Electrofishing		
				Shorthead sculpin	7
			Beach Seine		
				Longnose dace	20
		18-Oct-00			
			Backpack Electrofishing		
				Longnose dace	4
				Shorthead sculpin	5
	2 to 1				
		15-Aug-00			
			Boat Electrofish		
				Longnose sucker	3
				Mountain whitefish	4
				Mountain whitefish	5

Appendix D Table 8. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
St. Mary River					
	11				
		12-Aug-00			
			Backpack Electrofishing		
				Longnose dace	38
				Shorthead sculpin	7
	14				
		13-Aug-00			
			Backpack Electrofishing		
				Longnose dace	200
				Longnose dace	2
Milk River					
	2				
		08-Aug-00			
			Beach Seine		
				Sucker species	19
		22-Oct-00			
			Backpack Electrofishing		
				Longnose sucker	31
				Sauger	12
				White sucker	4
			Beach Seine		
				Flathead chub	1
				Flathead chub	2
				Longnose dace	1
				Sucker species	15
				Sucker species	1
				White sucker	2
	25				
		23-Oct-00			
			Backpack Electrofishing		
				Flathead chub	1
				Longnose dace	6
	26				
		20-Oct-00			
			Backpack Electrofishing		
				Longnose dace	22
				Longnose sucker	6
				Shorthead sculpin	4

Appendix D Table 8. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	23				
		22-Oct-00			
			Backpack Electrofishing		
				Flathead chub	30
				Flathead chub	9
				Longnose dace	6
				Longnose dace	5
				Longnose sucker	15
				Stonecat	1
				Stonecat	1
				Sucker species	50
	9				
		11-Aug-00			
			Backpack Electrofishing		
				Longnose dace	2
				Shorthead sculpin	3
			Beach Seine		
				Longnose dace	177
				Sucker species	46
		18-Oct-00			
			Backpack Electrofishing		
				Longnose dace	5
				Shorthead sculpin	18
	29				
		23-Oct-00			
			Backpack Electrofishing		
				Flathead chub	2
				Longnose dace	4
				Shorthead sculpin	4
	28				
		20-Oct-00			
			Backpack Electrofishing		
				Longnose dace	3
				Longnose dace	4
				Shorthead sculpin	2
	8				
		11-Aug-00			
			Backpack Electrofishing		
				Longnose dace	2
				Shorthead sculpin	1
				Shorthead sculpin	2

Appendix D Table 8. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	8				
		11-Aug-00			
			Beach Seine		
				Longnose sucker	4
				Sucker species	1
		19-Oct-00			
			Backpack Electrofishing		
				Longnose dace	9
				Shorthead sculpin	19
				Sucker species	1
	27				
		22-Oct-00			
			Backpack Electrofishing		
				Longnose dace	10
				Longnose dace	4
				Mountain sucker	2
				Stonecat	3
				Sucker species	4
	10				
		12-Aug-00			
			Backpack Electrofishing		
				Longnose dace	3
				Shorthead sculpin	1
		18-Oct-00			
			Backpack Electrofishing		
				Longnose dace	13
				Shorthead sculpin	10
	22				
		22-Oct-00			
			Beach Seine		
				Flathead chub	3
				Flathead chub	6
				Flathead chub	4
				Longnose dace	5
				Longnose sucker	1
				Sucker species	58
				Sucker species	3
				Sucker species	4
	7				
		10-Aug-00			
			Beach Seine		
				Longnose dace	3

Appendix D Table 8. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	7				
		10-Aug-00			
			Beach Seine		
				Longnose dace	21
				Longnose dace	9
				Sucker species	6
			Boat Electrofish		
				Sucker species	2
		19-Oct-00			
			Backpack Electrofishing		
				Longnose dace	4
				Shorthead sculpin	6
				Shorthead sculpin	1
	1				
		21-Oct-00			
			Backpack Electrofishing		
				Flathead chub	8
				Lake chub	1
				Longnose dace	25
				Longnose sucker	1
				Stonecat	2
				Stonecat	1
				White sucker	1
			Beach Seine		
				Flathead chub	2
				Flathead chub	3
				Flathead chub	12
				Flathead chub	42
				Flathead chub	810
				Longnose dace	4
				Sucker species	14
				Sucker species	8
				Sucker species	2
				White sucker	1
	4				
		09-Aug-00			
			Backpack Electrofishing		
				Longnose sucker	1
		19-Oct-00			
			Backpack Electrofishing		
				Longnose dace	6
				Longnose dace	6
				Shorthead sculpin	4

Appendix D Table 8. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	4				
		19-Oct-00			
			Backpack Electrofishing		
				Sucker species	2
				Sucker species	6
			Beach Seine		
				Flathead chub	39
				Flathead chub	9
				Longnose dace	2
				Longnose dace	1
				Longnose sucker	8
				Mountain sucker	3
				Sucker species	16
	5				
		10-Aug-00			
			Beach Seine		
				Longnose dace	3
				Longnose dace	2
				Longnose dace	12
				Sucker species	3
				Sucker species	7
				Sucker species	1
			Boat Electrofish		
				Longnose sucker	1
		19-Oct-00			
			Backpack Electrofishing		
				Shorthead sculpin	3
			Beach Seine		
				Longnose dace	2
				Shorthead sculpin	2
				Sucker species	6
				Sucker species	8
				Sucker species	11
	24				
		20-Oct-00			
			Backpack Electrofishing		
				Flathead chub	9
				Longnose dace	9
				Longnose dace	30
				Sucker species	4
			Beach Seine		
				Longnose dace	4

Appendix D Table 8. Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	24				
		20-Oct-00			
			Beach Seine		
				Longnose dace	2
				Longnose dace	2
				Sucker species	3
				Sucker species	1
	3				
		09-Aug-00			
			Beach Seine		
				Flathead chub	2
				Longnose dace	16
				Longnose dace	139
				Longnose dace	30
				Sucker species	164
				Sucker species	57
				Sucker species	16
		20-Oct-00			
			Backpack Electrofishing		
				Flathead chub	3
				Flathead chub	2
				Longnose dace	60
				Stonecat	1
				Stonecat	1
				Sucker species	1
				Sucker species	30
			Beach Seine		
				Flathead chub	4
				Longnose dace	23
				Longnose dace	46
				Longnose dace	22
				Sucker species	170
				Sucker species	19
				Sucker species	15
Lee Creek					
	20				
		13-Aug-00			
			Backpack Electrofishing		
				Longnose dace	57
				Longnose dace	600
				Shorthead sculpin	4
				Sucker species	75

Appendix D Table 8. Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Lee Creek					
	19				
		14-Aug-00			
			Backpack Electrofishing		
				Longnose dace	60
				Longnose dace	15
				Mountain sucker	10
				Unidentified	1
	17				
		13-Aug-00			
			Backpack Electrofishing		
				Longnose dace	50
				Mountain sucker	6
	18				
		14-Aug-00			
			Backpack Electrofishing		
				Cutthroat trout	2
				Longnose dace	100
				Longnose dace	25
				Mountain sucker	50
				Mountain sucker	8

Note: These data represent only fish that were released with no data (i.e., not measured) during seining or oberserved during electrofishing, and are not included in the life history appendices.

Appendix D Table 9. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2001.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Lee Creek					
	20				
		23-Oct-01			
			Backpack Electrofish		
				Longnose dace	38
				Rainbow trout	1
				St. Mary sculpin	3
				Sucker species	16
Milk River					
	1				
		18-Oct-01			
			Backpack Electrofish		
				Burbot	1
				Flathead chub	85
				Longnose dace	21
				Longnose sucker	14
	3				
		21-Oct-01			
			Backpack Electrofish		
				Flathead chub	12
				Longnose dace	37
				Longnose sucker	6
				Sucker species	34
	4				
		22-Oct-01			
			Backpack Electrofish		
				Flathead chub	233
				Lake chub	19
				Longnose dace	50
				St. Mary sculpin	3
				Sucker species	40
	9				
		23-Oct-01			
			Backpack Electrofish		
				Longnose dace	4
				Longnose dace	2
				St. Mary sculpin	4
				St. Mary sculpin	7
				White sucker	1
				White sucker	1

Appendix D Table 9. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2001.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	21				
		19-Oct-01			
			Beach Seine		
				Flathead chub	1263
				Longnose sucker	51
				White sucker	13
	23				
		21-Oct-01			
			Backpack Electrofish		
				Flathead chub	128
				Longnose dace	39
				Sucker species	114
	26				
		21-Oct-01			
			Backpack Electrofish		
				Longnose dace	44
				Longnose sucker	4
				St. Mary sculpin	5
				Sucker species	24
	27				
		22-Oct-01			
			Backpack Electrofish		
				Flathead chub	34
				Longnose dace	17
				St. Mary sculpin	2
				Stonecat	3
				Sucker species	21
	28				
		22-Oct-01			
			Backpack Electrofish		
				Flathead chub	15
				Longnose dace	10
				Longnose dace	66
				St. Mary sculpin	2
				Sucker species	1
				Sucker species	9
	30				
		18-Jul-01			
			Beach Seine		
				Flathead chub	42
				Flathead chub	13

Appendix D Table 9. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2001.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	30				
		18-Jul-01			
			Beach Seine		
				Longnose dace	2
				Sucker species	2
				Sucker species	10
	31				
		18-Jul-01			
			Beach Seine		
				Flathead chub	159
				Flathead chub	18
				Longnose dace	1
				Longnose dace	2
				Sucker species	7
				Sucker species	44
	32				
		19-Jul-01			
			Beach Seine		
				Flathead chub	53
				Flathead chub	31
				Longnose dace	6
				Sucker species	26
				Sucker species	9
	33				
		19-Jul-01			
			Beach Seine		
				Flathead chub	11
				Flathead chub	12
				Flathead chub	110
				Longnose dace	1
				Longnose dace	2
				Sucker species	3
				Sucker species	54
				Sucker species	6
	34				
		19-Jul-01			
			Beach Seine		
				Flathead chub	41
				Longnose dace	32
				Sucker species	20

Appendix D Table 9. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2001.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	35				
		19-Jul-01			
			Beach Seine		
				Flathead chub	53
				Longnose dace	13
				Sucker species	19
	36				
		19-Jul-01			
			Beach Seine		
				Flathead chub	68
				Sucker species	25
		19-Oct-01			
			Backpack Electrofish		
				Flathead chub	196
				Longnose dace	8
				Longnose sucker	6
	37				
		20-Jul-01			
			Beach Seine		
				Flathead chub	7
				Flathead chub	14
				Sucker species	4
				Sucker species	9
	38				
		20-Jul-01			
			Beach Seine		
				Flathead chub	34
				Sucker species	6
				Sucker species	34
	39				
		20-Jul-01			
			Beach Seine		
				Flathead chub	44
				Flathead chub	26
				Longnose dace	15
				Longnose dace	9
				Sucker species	13
				Sucker species	8

Appendix D Table 9. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2001.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	42				
		18-Oct-01			
			Backpack Electrofish		
				Flathead chub	131
				Longnose sucker	4
	45				
		19-Oct-01			
			Backpack Electrofish		
				Flathead chub	93
				Longnose dace	8
				Longnose sucker	9
				Sucker species	4
				White sucker	5
	46				
		19-Oct-01			
			Beach Seine		
				Flathead chub	151
				Longnose sucker	20
				White sucker	2
	47				
		19-Oct-01			
			Beach Seine		
				Flathead chub	1250
				Sucker species	40
				Western silvery minno	1
	48				
		20-Oct-01			
			Backpack Electrofish		
				Flathead chub	63
				Longnose dace	42
				Sucker species	61
	49				
		20-Oct-01			
			Beach Seine		
				Flathead chub	311
				Longnose dace	35
				Longnose sucker	11
				Sucker species	31
				White sucker	218

Appendix D Table 9. **Number of fish observed during backpack electrofishing and those released with no data during beach seining in the Milk and St. Mary Rivers Study Area, 2001.**

Waterbody	Site No.	Date	Sampling Method	Species	No. Fish Counted during Seining /Observed during Electrofishing
Milk River					
	50				
		20-Oct-01			
			Beach Seine		
				Flathead chub	61
				Longnose dace	10
				Sucker species	295
				Trout perch	2
	51				
		20-Oct-01			
			Beach Seine		
				Flathead chub	85
				Longnose dace	115
				Sucker species	766
				Trout perch	3
St. Mary River					
	12				
		23-Oct-01			
			Backpack Electrofish		
				Longnose dace	4
				Mountain whitefish	1
				St. Mary sculpin	10
				Sucker species	3
	15				
		23-Oct-01			
			Backpack Electrofish		
				Longnose dace	9
				St. Mary sculpin	14
				Sucker species	11

Note: These data represent only fish that were released with no data (i.e., not measured) during seining or observed during electrofishing, and are not included in the life history appendices.

APPENDIX E

Habitat Data

Appendix E Table 1. Stream condition for sites sampled in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Sampling Date	Water Temperature (°C)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Colour	Stage
Lee Creek									
	17								
		13-Aug-00	19.1	320	8.6	1.18	8.9	Clear	Low
	18								
		14-Aug-00	20.5	330	8.7	1.26	9.5	Clear	Low
	19								
		14-Aug-00	23.6	340	8.9	2.37	8.9	Clear	Low
	20								
		13-Aug-00	16.3	420	8.6	2.17	11.4	Clear	Low
Lost River									
	1a								
		08-Aug-00	0	0	0	0	0	Dry Channel	Nil
Milk River									
	1								
		08-Aug-00	22.4	160	6.5	52.7	7.9	Milky Brown	Low
		21-Oct-00	8.7	520	8.6	1.75	11.2	Brown	Low
	2								
		08-Aug-00	26.5	170	8.4	25.2	8.3	Milky Brown	Low
		22-Oct-00	2.2	480	8.7	1.98	12.1	Clear Brown	Low
	3								
		08-Sep-00	20.7	150	8.2	19.6	7.9	Milky Brown	Low
		20-Oct-00	10	470		1.08	9.5	Brown	Low
	4								
		09-Aug-00	22.8	130	8.5	10.3	7.4	Milky Brown	Low
		19-Oct-00	9.5	360	8.5	3.34	11.1	Clear	Low
	5								
		10-Aug-00	21.6	120	8.6	11	8.2	Milky Brown	Low
		19-Oct-00	11	280	6.2	1.81	11.1	Clear	Low
	6								
		10-Aug-00	0	0	0	0	0	Dry Channel	Nil
	7								
		10-Aug-00	18.9	110	8.6	6.7	7.4	Blue	Medium
		19-Oct-00	8.6	310	8.6	2.86	11.1	Milky Blue	Low
	8								
		11-Aug-00	19.5	100	8.6	3.9	9	Grey	Low
		19-Oct-00	6.5	300	8.6	1.55	10.8	Clear	Low
	9								
		11-Aug-00	20.7	110	8.6	3.6	8.2	Grey	Low
		18-Oct-00	10	270	8.6	1.73	10.6	Milky grey	Low

Appendix E Table 1. Stream condition for sites sampled in the Milk and St. Mary Rivers Study Area, 2000.

Waterbody	Site No.	Sampling Date	Water Temperature (°C)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Colour	Stage
Milk River									
	10								
		12-Aug-00	19.4	120	8.6	6.8	8.3	Grey	Low
		18-Oct-00	10	270	8.6	1.66	10.8	Brown	Low
	21								
		21-Oct-00	8	570	8.8	1.77	11.2	Brown	Low
	22								
		22-Oct-00	5.3	570	8.6	1.16	11.7	Clear Brown	Low
	23								
		22-Oct-00	8.3	490	8.6	1.22	10.7	Clear Brown	Low
	24								
		20-Oct-00	9	470	8.5	1.8	11.2	Brown	Low
	25								
		23-Oct-00	3	530	8.6	1.13		Clear	Low
	26								
		20-Oct-00	6	520	8.4	1.49	11.6	Clear	Low
	27								
		22-Oct-00	6	390		1.26	10.6	Clear	Low
	28								
		20-Oct-00	5	440	8.5	1.39	11.1	Clear	Low
	29								
		23-Oct-00	2.1	370	8.3	1.38	11.1	Clear	Low
St. Mary River									
	11								
		12-Aug-00	20.3	130	8.6	0.72	8	Blue	Low
	12								
		12-Aug-00	20.7	130	8.6	1.38	7.9	Blue	Low
		18-Oct-00	8.5	110	8.4	1.77	10.8	Clear	Low
	13								
		13-Aug-00	20	110	8.6	2.15	8.5	Clear	Low
	14								
		13-Aug-00	20.1	120	8.7	1.86	8.8	Clear	Low
	15								
		14-Aug-00	16.3	150	8.6	3.16	9.2	Clear	Low
		18-Oct-00	8.5	110	8	2.9	10.4	Grey/Blue	Low
	16								
		15-Aug-00	18.9	150	8.4	2.45	10.6	Clear	Low
	12 to 14								
		15-Aug-00	17.5	150				Clear	Low

Appendix E Table 2. Stream conditions for sites sampled in the Milk and St. Mary Rivers Study Area, 2001.

Waterbody	Site No.	Sampling Date	Water Temperature (°C)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Colour	Stage
Lee Creek									
	20								
		23-Oct-01	5.1	430	8.4	1.72	12.3	Clear	Low
Milk River									
	1								
		18-Oct-01	5.2	610	8.3	11.16	11.2	Clear	Low
	3								
		21-Oct-01	3.9	920	8.3	1.12	12.2	Clear	Low
	4								
		22-Oct-01	7.7	590	8	1.83	11.4	Clear	Low
	9								
		23-Oct-01	2.7	390	8.3	0.91	12.3	Clear	Low
	21								
		19-Oct-01	4.1	840	8.8	11.15	11	Clear	Low
	23								
		21-Oct-01	2.5	990	8.3	1.23	12.5	Clear	Low
	26								
		21-Oct-01	4.8	900	8.4	1.35	12.8	Clear	Low
	27								
		22-Oct-01	6.5	780	8.4	2.66	11.5	Clear	Low
	28								
		22-Oct-01	2.5	720	8.2	2.22	11.8	Clear	Low
	30								
		18-Jul-01	21	130	7.8	76.7		Grey	Low
	31								
		18-Jul-01	21	130	7.8	76.7		Grey	Low
	32								
		19-Jul-01	21	130	7.8			Grey	Low
	33								
		19-Jul-01	21	120	7.8	65.5		Milky brown	Low
	34								
		19-Jul-01	21.5	120	7.8			Grey	Low
	35								
		19-Jul-01	21.5	120	7.8			Grey	Low
	36								
		19-Jul-01	25.1	130	8	43.5	7.9	Grey	Low
		19-Oct-01	9.2	760	8.3	6.47	11.2	Clear	Low
	37								
		20-Jul-01	23	130	8.2		7.3	Grey	Low
	38								
		20-Jul-01	22	120	8	47.6	8.2	Grey	Low
	39								
		20-Jul-01							Low
	40								
		18-Oct-01	5.3	460	8.2		10.5	Light Brown	Low

Appendix E Table 2. Stream conditions for sites sampled in the Milk and St. Mary Rivers Study Area, 2001.

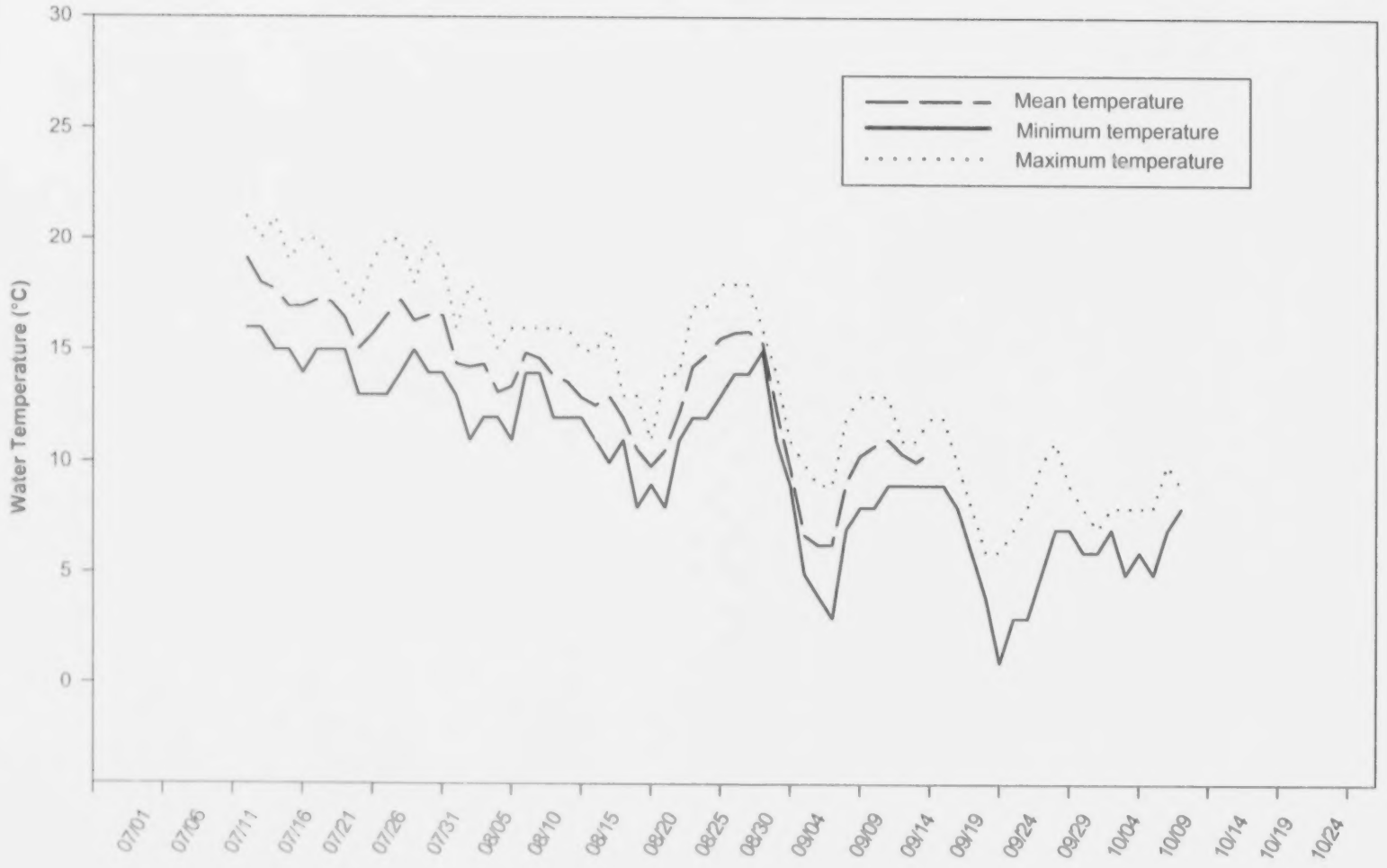
Waterbody	Site No.	Sampling Date	Water Temperature (°C)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Colour	Stage
Milk River									
	41								
		18-Oct-01	7.3	1060	8.3	3.98	11.2	Clear	Low
	42								
		18-Oct-01						Clear	Low
	43								
		18-Oct-01						Clear	Low
	44								
		19-Oct-01						Clear	Low
	45								
		19-Oct-01	8.1	980	9		13.5	Clear	Low
	46								
		19-Oct-01	8.1	350	8	4.24	10.8	Clear	Low
	47								
		19-Oct-01	10.3	1990	8.3		12.9	Clear	Low
	48								
		20-Oct-01	7.8	970	8.5	2.69	12.3	Clear	Low
	49								
		20-Oct-01						Clear	Low
	50								
		20-Oct-01	9.5	1120	8.3		11.3	Milky Brown	Low
	51								
		20-Oct-01							Low
St. Mary River									
	12								
		23-Oct-01	3.7	200	8	0.34	12.2	Clear	Low
	15								
		23-Oct-01	4.5	220	8.1	0.61	11.7	Clear	Low

Appendix E Table 3. Daily water temperatures recorded in the St. Mary River, 2000.

Date	Mean (C)	Minimum (C)	Maximum (C)
8/12/2000	19.1	16.0	21.0
8/13/2000	18.0	16.0	20.0
8/14/2000	17.7	15.0	21.0
8/15/2000	16.9	15.0	19.0
8/16/2000	17.0	14.0	20.0
8/17/2000	17.2	15.0	20.0
8/18/2000	17.2	15.0	19.0
8/19/2000	16.4	15.0	18.0
8/20/2000	15.1	13.0	17.0
8/21/2000	15.7	13.0	19.0
8/22/2000	16.6	13.0	20.0
8/23/2000	17.2	14.0	20.0
8/24/2000	16.3	15.0	18.0
8/25/2000	16.6	14.0	20.0
8/26/2000	16.6	14.0	19.0
8/27/2000	14.4	13.0	16.0
8/28/2000	14.3	11.0	18.0
8/29/2000	14.4	12.0	17.0
8/30/2000	13.1	12.0	15.0
8/31/2000	13.4	11.0	16.0
9/1/2000	14.9	14.0	16.0
9/2/2000	14.7	14.0	16.0
9/3/2000	13.9	12.0	16.0
9/4/2000	13.6	12.0	16.0
9/5/2000	12.9	12.0	15.0
9/6/2000	12.6	11.0	15.0
9/7/2000	13.0	10.0	16.0
9/8/2000	12.0	11.0	13.0
9/9/2000	10.6	8.0	13.0
9/10/2000	9.9	9.0	11.0
9/11/2000	10.5	8.0	14.0
9/12/2000	12.2	11.0	14.0
9/13/2000	14.3	12.0	17.0
9/14/2000	14.9	12.0	17.0
9/15/2000	15.6	13.0	18.0
9/16/2000	15.8	14.0	18.0
9/17/2000	15.9	14.0	18.0
9/18/2000	15.4	15.0	16.0

Appendix E Table 3. Daily water temperatures recorded in the St. Mary River, 2000.

Date	Mean (C)	Minimum (C)	Maximum (C)
9/19/2000	12.4	11.0	14.0
9/20/2000	9.8	9.0	11.0
9/21/2000	6.7	5.0	10.0
9/22/2000	6.3	4.0	9.0
9/23/2000	6.3	3.0	9.0
9/24/2000	9.2	7.0	12.0
9/25/2000	10.3	8.0	13.0
9/26/2000	10.8	8.0	13.0
9/27/2000	11.1	9.0	13.0
9/28/2000	10.4	9.0	11.0
9/29/2000	10.1	9.0	11.0
9/30/2000	10.5	9.0	12.0
10/1/2000	10.2	9.0	12.0
10/2/2000	8.7	8.0	10.0
10/3/2000	6.6	6.0	8.0
10/4/2000	4.5	4.0	6.0
10/5/2000	3.5	1.0	6.0
10/6/2000	4.9	3.0	7.0
10/7/2000	5.4	3.0	8.0
10/8/2000	7.5	5.0	10.0
10/9/2000	8.7	7.0	11.0
10/10/2000	8.3	7.0	9.0
10/11/2000	6.7	6.0	8.0
10/12/2000	6.4	6.0	7.0
10/13/2000	7.3	7.0	8.0
10/14/2000	6.8	5.0	8.0
10/15/2000	7.0	6.0	8.0
10/16/2000	7.0	5.0	8.0
10/17/2000	8.2	7.0	10.0
10/18/2000	8.2	8.0	9.0



Appendix E Daily water temperatures in the St. Mary River, 2000.

Appendix E Table 4. Daily water temperatures recorded in the Milk River, 2001.

Date	Mean (C)	Minimum (C)	Maximum (C)
7/22/2001	20.4	19.9	21.3
7/23/2001	19.6	19.4	19.9
7/24/2001	19.4	19.4	19.4
7/25/2001	19.3	19.1	19.4
7/26/2001	19.0	18.9	19.2
7/27/2001	19.1	19.1	19.2
7/28/2001	19.4	19.2	19.5
7/29/2001	18.2	17.5	19.4
7/30/2001	17.2	16.6	18.1
7/31/2001	16.7	15.5	18.1
8/1/2001	16.8	14.0	20.2
8/2/2001	20.0	16.3	24.0
8/3/2001	21.5	17.8	25.2
8/4/2001	22.0	19.4	24.9
8/5/2001	20.4	17.5	23.2
8/6/2001	21.5	17.5	25.6
8/7/2001	22.9	19.4	26.1
8/8/2001	19.2	17.7	22.6
8/9/2001	18.9	14.5	23.9
8/10/2001	20.7	16.2	25.4
8/11/2001	21.9	17.5	26.4
8/12/2001	22.3	18.0	27.1
8/13/2001	21.7	18.6	24.9
8/14/2001	20.9	17.2	25.2
8/15/2001	21.8	17.4	27.1
8/16/2001	23.2	18.8	28.0
8/17/2001	22.5	18.4	27.1
8/18/2001	20.9	16.6	26.8
8/19/2001	19.7	15.4	24.0
8/20/2001	18.5	14.2	23.6
8/21/2001	18.3	13.2	24.0
8/22/2001	20.1	14.6	26.6

Appendix E Table 4. Daily water temperatures recorded in the Milk River, 2001.

Date	Mean (C)	Minimum (C)	Maximum (C)
8/23/2001	19.3	16.8	22.6
8/24/2001	16.4	13.5	20.0
8/25/2001	16.2	12.3	20.2
8/26/2001	17.3	14.3	20.6
8/27/2001	17.7	13.8	22.6
8/28/2001	17.5	14.2	21.0
8/29/2001	17.3	13.8	21.9
8/30/2001	17.9	13.9	22.4
8/31/2001	16.5	13.0	20.0
9/1/2001	16.0	13.9	17.8
9/2/2001	15.1	12.9	17.1
9/3/2001	16.2	13.6	18.1
9/4/2001	16.9	13.8	19.5
9/5/2001	15.9	14.3	19.2
9/6/2001	14.4	11.4	17.1
9/7/2001	13.3	12.0	15.1
9/8/2001	11.9	8.9	14.8
9/9/2001	13.3	11.2	15.1
9/10/2001	13.2	11.8	14.3
9/11/2001	12.8	11.4	14.0
9/12/2001	14.1	11.5	17.4
9/13/2001	13.5	9.9	16.3
9/14/2001	14.9	11.7	17.4
9/15/2001	15.8	13.0	18.0
9/16/2001	14.8	11.8	16.8
9/17/2001	15.3	12.0	17.8
9/18/2001	16.2	13.9	18.8
9/19/2001	14.7	13.0	16.6
9/20/2001	12.8	10.2	14.9
9/21/2001	13.4	9.8	15.9
9/22/2001	12.2	9.5	16.2
9/23/2001	14.2	11.1	16.9

Appendix E Table 4. Daily water temperatures recorded in the Milk River, 2001.

Date	Mean (C)	Minimum (C)	Maximum (C)
9/24/2001	15.4	12.4	18.0
9/25/2001	15.6	12.7	18.6
9/26/2001	14.8	13.6	16.2
9/27/2001	13.7	12.0	15.5
9/28/2001	14.1	12.4	15.2
9/29/2001	13.6	11.2	15.7
9/30/2001	12.7	10.2	14.3
10/1/2001	12.3	10.1	14.0
10/2/2001	10.8	8.4	12.1
10/3/2001	9.7	8.1	11.1
10/4/2001	7.9	6.4	9.0
10/5/2001	6.4	4.6	8.4
10/6/2001	7.6	5.2	9.9
10/7/2001	7.8	5.0	10.1
10/8/2001	8.5	6.2	10.2
10/9/2001	8.1	6.2	9.6
10/10/2001	7.5	5.3	9.2
10/11/2001	7.0	5.9	7.8
10/12/2001	5.8	4.0	7.3
10/13/2001	5.6	4.4	7.7
10/14/2001	4.9	2.9	6.4
10/15/2001	4.1	2.2	7.7
10/16/2001	5.9	2.2	10.9
10/17/2001	6.0	3.4	8.3
10/18/2001	3.1	1.1	6.4
10/19/2001	4.2	0.8	8.4
10/20/2001	4.6	1.9	8.6

Appendix E Table E5 WATER SURVEY OF CANADA ST. MARY RIVER AT INTERNATIONAL BOUNDARY STATION O.
05AE027
2002-02-08 09:25
CALGARY, ALTA.

CompuMod 1.6

(PRELIMINARY) DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2001

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	1.70 B	1.30 B	1.47 B	1.70 B	9.57	41.6	20.6	8.07	5.77	3.91	4.16	4.39 B	1
2	1.64 B	1.36 B	1.39 B	1.87 B	10.1	37.4	18.8	7.30	5.60	3.42	4.39	4.53 B	2
3	1.64 B	1.30 B	1.36 B	2.26 B	11.0	35.9	19.4	7.19	5.15	3.28	4.19	4.25 B	3
4	1.64 B	1.19 B	1.36 B	2.55 B	11.6	54.1	20.6	7.10	4.92	3.14	4.08	4.25 B	4
5	1.64 B	1.13 B	1.30 B	2.43 B	12.0	57.7	21.1	6.74	4.81	3.08	4.02	4.25 B	5
6	1.67 B	1.08 B	1.30 B	2.38 B	11.6	54.6	22.0	6.06	4.92	2.94	3.85	4.10 B	6
7	1.70 B	1.13 B	1.27 B	2.26 B	11.5	50.4	22.4	6.23	5.26	2.72	3.76	4.25 B	7
8	1.70 B	1.16 B	1.27 B	2.38 B	11.4	45.3	21.4	9.34	5.32	2.77	3.96	4.25 B	8
9	1.70 B	1.19 B	1.30 B	2.55 B	11.7	41.6	20.1	11.9	5.04	2.63	3.68	4.10 B	9
10	1.70 B	1.19 B	1.30 B	2.66 B	12.2	38.8	19.2	12.3	4.73	2.46	3.91	3.82 B	10
11	1.64 B	1.16 B	1.30 B	2.55 B	12.8	35.1	18.9	12.4	4.58	2.41	3.68	3.68 B	11
12	1.58 B	1.19 B	1.25 B	2.66 B	12.6	34.5	18.5	11.0	4.44	2.41	3.57	3.40 B	12
13	1.58 B	1.16 B	1.25 B	2.83 B	16.3	35.1	19.1	10.8	4.27	2.35	3.37	3.40 B	13
14	1.64 B	1.19 B	1.42 B	2.66 B	29.7	34.8	18.6	12.8	4.16	2.09	3.25	3.68 B	14
15	1.70 B	1.19 B	1.64 B	2.55 B	35.1	33.1	18.0	12.4	4.05	1.98	3.71	3.54 B	15
16	1.75 B	1.19 B	1.70 B	2.43 B	38.2	32.5	17.3	11.9	3.93	1.98	3.37	3.40 B	16
17	1.75 B	1.22 B	1.64 B	2.26 B	38.8	31.4	16.3	11.3	3.91	2.04	3.37	3.11 B	17
18	1.70 B	1.25 B	1.64 B	2.55 B	35.9	33.1	15.1	11.0	3.82	2.04	3.45	2.97 B	18
19	1.70 B	1.25 B	1.58 B	4.53	32.8	32.8	14.1	10.7	3.71	2.07	3.57	2.97 B	19
20	1.75 B	1.25 B	1.70 B	4.70	29.4	31.4	13.6	10.4	3.65	1.87	3.88	2.83 B	20
21	1.70 B	1.19 B	1.81 B	4.64	25.9	30.6	13.2	10.0	5.35	1.75	4.05	2.72 B	21
22	1.64 B	1.19 B	1.92 B	5.60	23.1	30.8	12.9	9.62	6.82	1.67	4.30	2.60 B	22
23	1.58 B	1.19 B	1.87 B	5.63	23.1	32.3	12.5	9.37	7.81	1.84	4.44	2.49 B	23
24	1.53 B	1.16 B	1.81 B	5.52	28.1	32.8	12.5	9.06	8.57	1.95	4.47	2.43 B	24
25	1.47 B	1.19 B	1.81 B	9.31	34.8	33.1	12.5	8.72	8.55	1.98	4.36	2.38 B	25
26	1.42 B	1.30 B	1.81 B	8.46	42.7	31.7	11.4	8.21	8.21	2.07	4.10 B	2.26 B	26
27	1.47 B	1.42 B	1.75 B	8.57	49.5	30.3	10.7	7.81	6.57	2.21	3.96 B	2.21 B	27
28	1.47 B	1.42 B	1.75 B	9.57	54.9	28.2	10.2	7.36	5.60	2.86	4.25 B	2.21 B	28
29	1.42 B		1.70 B	10.5	58.0	26.0	9.59	6.68	4.95	2.89	4.25 B	2.15 B	29
30	1.36 B		1.64 B	11.3	55.8	23.1	8.97	6.20	4.36	3.17	4.25 B	2.09 B	30
31	1.36 B		1.70 B		49.8		8.35	5.94		3.59		2.04 B	31
TOTAL	49.94	34.14	48.01	131.86	839.97	1090.1	497.91	285.90	158.83	77.57	117.65	100.75	TOTAL
MEAN	1.61	1.22	1.55	4.40	27.1	36.3	16.1	9.22	5.29	2.50	3.92	3.25	MEAN
DAM3	4310	2950	4150	11400	72600	94200	43000	24700	13700	6700	10200	8700	DAM3
MAX	1.75	1.42	1.92	11.3	58.0	57.7	22.4	12.8	8.57	3.91	4.47	4.53	MAX
MIN	1.36	1.08	1.25	1.70	9.57	23.1	8.35	5.94	3.65	1.67	3.25	2.04	MIN

SUMMARY FOR THE YEAR 2001

A - MANUAL GAUGE
B - ICE CONDITIONS
E - ESTIMATED

Total discharge, 297000 DAM3
Mean discharge, 9.40 M3/S
Maximum daily discharge, 58.0 M3/S On 2001-05-29
Minimum daily discharge, not valid
Max Inst discharge, not valid
Min Inst discharge, not valid

Appendix E Table E6
NO. 11AA001
STATION 2002-01-22 07:54
CALGARY, ALTA.

WATER SURVEY OF CANADA NORTH MILK RIVER NEAR INTERNATIONAL BOUNDARY

CompuMod 1.6

(FINAL) DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2001

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	---	---	0.220 B	0.340 B	15.9	21.1	18.1	16.7	0.130	0.164	---	---	1
2	---	---	0.222 B	0.350 B	19.0	20.8	17.9	16.4	0.128	0.169	---	---	2
3	---	---	0.225 B	0.420 B	20.3	20.6	17.8	16.3	0.135	0.178	---	---	3
4	---	---	0.230 B	0.500 B	20.8	21.6	17.8	16.3	0.139	0.193	---	---	4
5	---	---	0.255 B	0.680 B	20.9	21.3	18.1	16.2	0.146	0.209	---	---	5
6	---	---	0.280 B	0.570 B	20.4	21.5	17.9	16.1	0.163	0.207	---	---	6
7	---	---	0.280 B	0.530 B	20.4	20.9	18.0	14.6	0.185	0.205	---	---	7
8	---	---	0.310 B	0.550 B	20.5	20.7	18.1	11.8	0.207	0.204	---	---	8
9	---	---	0.340 B	0.510 B	20.2	20.4	18.2	8.81	0.182	0.203	---	---	9
10	---	---	0.310 B	0.480 B	20.2	19.8	18.2	6.80	0.165	0.204	---	---	10
11	---	---	0.310 B	0.450 B	20.1	19.5	18.1	4.85	0.168	0.206	---	---	11
12	---	---	0.340 B	0.450 B	20.1	19.8	18.0	3.23	0.177	0.210	---	---	12
13	---	---	0.340 B	0.450 B	21.0	20.1	17.9	2.92	0.178	0.203	---	---	13
14	---	---	0.225 B	0.425 B	21.2	20.2	17.8	2.27	0.171	0.209	---	---	14
15	---	---	0.170 B	0.450 B	21.6	19.8	17.6	0.868	0.168	0.213	---	---	15
16	---	---	0.140 B	0.510 B	22.0	19.6	17.5	0.442	0.170	0.219	---	---	16
17	---	---	0.200 B	0.650 B	21.3	19.5	17.3	0.330	0.171	0.210	---	---	17
18	---	---	0.235 B	1.21	21.0	20.0	17.2	0.313	0.173	0.211	---	---	18
19	---	---	0.320 B	1.27	20.8	19.7	16.9	0.236	0.175	0.212	---	---	19
20	---	---	0.430 B	1.90	20.6	19.2	16.9	0.181	0.176	0.213	---	---	20
21	---	---	0.496 B	3.78	20.7	18.9	16.9	0.148	0.177	0.215	---	---	21
22	---	---	0.430 B	4.43	20.5	18.7	17.1	0.133	0.180	0.256	---	---	22
23	---	---	0.300 B	5.63	20.4	18.6	17.2	0.126	0.177	0.228	---	---	23
24	---	---	0.260 B	8.40	20.5	18.6	17.2	0.126	0.168	0.224	---	---	24
25	---	---	0.295 B	22.8	20.8	18.6	17.1	0.128	0.158	0.232	---	---	25
26	---	---	0.315 B	22.9	21.1	18.7	16.8	0.132	0.164	0.235	---	---	26
27	---	---	0.325 B	14.2	21.5	18.8	16.7	0.133	0.164	0.239	---	---	27
28	---	---	0.327 B	13.8	22.2	18.6	16.8	0.135	0.176	0.247	---	---	28
29	---		0.370 B	14.1	22.5	18.3	16.6	0.137	0.172	0.254	---	---	29
30	---		0.325 B	13.7	22.2	18.1	16.4	0.135	0.167	0.251	---	---	30
31	---		0.330 B		21.8		16.8	0.132		0.255		---	31
OTAL			9.155	136.435	642.5	592.0	540.9	157.115	5.010	6.678			TOTAL
MEAN			0.295	4.55	20.7	19.7	17.4	5.07	0.167	0.215			MEAN
DAM3			791	11800	55500	51100	46700	13600	433	577			DAM3
MAX			0.496	22.9	22.5	21.6	18.2	16.7	0.207	0.256			MAX
MIN			0.140	0.340	15.9	18.1	16.4	0.126	0.128	0.164			MIN

SUMMARY FOR THE YEAR 2001

A - MANUAL GAUGE
B - ICE CONDITIONS
E - ESTIMATED

Maximum daily discharge, 22.9 M3/S On 2001-04-26
Minimum daily discharge, not valid
Max Inst discharge, 44.4 M3/S @ 03:33:00 MST On 2001-04-26
Min Inst discharge, not valid
REMARKS,

HQ #19.00: 1998-02-25 to open shift corr

Appendix E Table E7 WATER SURVEY OF CANADA NORTH FORK MILK RIVER ABOVE ST. MARY CANAL STATION O.
11AA032
2002-02-08 09:28
CALGARY, ALTA.

CompuMod 1.6

(PRELIMINARY) DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2001

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	---	---	0.153 B	0.283 B	0.481	0.283	0.218	0.246	0.150	0.201	---	---	1
2	---	---	0.142 B	0.311 B	0.425	0.277	0.207	0.232	0.153	0.173	---	---	2
3	---	---	0.142 B	0.340 B	0.396	0.283	0.201	0.209	0.161	0.187	---	---	3
4	---	---	0.170 B	0.396 B	0.396	0.509	0.201	0.201	0.153	0.212	---	---	4
5	---	---	0.212 B	0.396 B	0.425	0.368	0.195	0.218	0.190	0.232	---	---	5
6	---	---	0.226 B	0.368 B	0.396	0.368	0.198	0.201	0.198	0.241	---	---	6
7	---	---	0.226 B	0.340 B	0.396	0.311	0.198	0.192	0.226	0.238	---	---	7
8	---	---	0.255 B	0.340 B	0.368	0.283	0.192	0.198	0.232	0.229	---	---	8
9	---	---	0.283 B	0.340 B	0.396	0.283	0.192	0.229	0.209	0.229	---	---	9
10	---	---	0.255 B	0.311 B	0.396	0.266	0.192	0.226	0.198	0.226	---	---	10
11	---	---	0.277 B	0.272 B	0.368	0.260	0.192	0.218	0.198	0.232	---	---	11
12	---	---	0.283 B	0.272 B	0.368	0.283	0.204	0.209	0.198	0.232	---	---	12
13	---	---	0.283 B	0.255 B	0.368	0.368	0.226	0.204	0.198	0.226	---	---	13
14	---	---	0.198 B	0.255 B	0.396	0.311	0.212	0.207	0.195	0.232	---	---	14
15	---	---	0.127 B	0.269 B	0.368	0.283	0.207	0.209	0.195	0.238	---	---	15
16	---	---	0.113 B	0.311	0.368	0.283	0.221	0.212	0.192	0.243	---	---	16
17	---	---	0.142 B	0.396	0.340	0.263	0.221	0.212	0.192	0.238	---	---	17
18	---	---	0.170 B	0.792	0.340	0.340	0.212	0.209	0.187	0.226	---	---	18
19	---	---	0.226 B	0.764	0.340	0.368	0.212	0.201	0.190	0.229	---	---	19
20	---	---	0.283 B	0.736	0.340	0.277	0.207	0.170	0.192	0.249	---	---	20
21	---	---	0.340 B	0.509	0.340	0.255	0.207	0.142	0.204	0.340	---	---	21
22	---	---	0.283 B	0.566	0.311	0.243	0.215	0.119	0.204	0.283	---	---	22
23	---	---	0.226 B	0.991	0.311	0.229	0.221	0.105	0.204	0.272	---	---	23
24	---	---	0.215 B	2.60	0.311	0.221	0.226	0.108	0.204	0.266	---	---	24
25	---	---	0.226 B	13.2	0.311	0.226	0.238	0.113	0.198	0.269	---	---	25
26	---	---	0.255 B	7.67	0.311	0.229	0.229	0.119	0.192	0.272	---	---	26
27	---	---	0.266 B	1.87	0.311	0.238	0.221	0.113	0.209	0.283	---	---	27
28	---	---	0.283 B	1.08	0.311	0.226	0.212	0.127	0.232	0.283	---	---	28
29	---		0.311 B	0.764	0.283	0.218	0.207	0.139	0.209	0.269	---	---	29
30	---		0.283 B	0.538	0.283	0.215	0.207	0.127	0.218	0.260	---	---	30
31	---		0.283 B		0.283		0.209	0.147		0.260		---	31
TOTAL			7.137	37.535	11.037	8.567	6.500	5.562	5.881	7.570			TOTAL
MEAN			0.230	1.25	0.356	0.286	0.210	0.179	0.196	0.244			MEAN
DAM3			617	3240	954	740	562	481	508	654			DAM3
MAX			0.340	13.2	0.481	0.509	0.238	0.246	0.232	0.340			MAX
MIN			0.113	0.255	0.283	0.215	0.192	0.105	0.150	0.173			MIN

SUMMARY FOR THE YEAR 2001

A - MANUAL GAUGE
B - ICE CONDITIONS
E - ESTIMATED

Maximum daily discharge, 13.2 M3/S On 2001-04-25
Minimum daily discharge, not valid
Max Inst discharge, 13.2 M3/S @ 00:00:00 On 2001-04-25
Min Inst discharge, not valid

Appendix E Table E8
NO. 11AA005
STATION 2002-01-22 09:56
CALGARY, ALTA.

WATER SURVEY OF CANADA MILK RIVER AT MILK RIVER

CompuMod 1.6

(FINAL) DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2001

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	0.195 B	0.302 B	0.280 B	1.23 B	18.5	18.2	15.8	16.3	0.113	0.103 E	0.355	0.058 B	1
2	0.198 B	0.310 B	0.300 B	1.30 B	18.7	17.7	15.6	15.9	0.112	0.112 A	0.333	0.060 B	2
3	0.200 B	0.320 B	0.305 B	1.28 B	19.6	17.7	15.4	15.7	0.101	0.131	0.306	0.051 B	3
4	0.205 B	0.330 B	0.310 B	1.30 B	19.5	18.4	15.4	15.6	0.071	0.157	0.285	0.054 B	4
5	0.210 B	0.337 B	0.350 B	1.35 B	19.2	18.7	15.3	15.4	0.053	0.179	0.288	0.057 B	5
6	0.215 B	0.344 B	0.375 B	1.45 B	19.1	18.7	15.3	15.4	0.069	0.189	0.280	0.074 B	6
7	0.225 B	0.330 B	0.400 B	1.51 B	19.4	19.2	15.2	15.2	0.108	0.192	0.260	0.064 B	7
8	0.250 B	0.300 B	0.430 B	1.87	19.4	19.1	15.2	14.2	0.106	0.204	0.262	0.069 B	8
9	0.270 B	0.275 B	0.460 B	2.16	19.0	18.7	15.3	12.7	0.102	0.216	0.265	0.072 B	9
10	0.291 B	0.255 B	0.430 B	2.58	18.9	18.2	15.4	10.7	0.097	0.226	0.227	0.066 B	10
11	0.295 B	0.238 B	0.440 B	2.13	19.0	17.5	15.4	9.10	0.078	0.236	0.217	0.068 B	11
12	0.288 B	0.220 B	0.460 B	1.83	18.7	17.3	15.5	7.84	0.067	0.243	0.226	0.071 B	12
13	0.275 B	0.200 B	0.505 B	1.68	18.7	17.6	15.9	6.02	0.063	0.230	0.331	0.074 B	13
14	0.258 B	0.195 B	0.525 B	1.58	18.8	17.7	15.8	5.40	0.086	0.225	0.278	0.072 B	14
15	0.250 B	0.190 B	0.525 B	1.61	18.9	17.7	15.6	5.10	0.080	0.215	0.279	0.080 B	15
16	0.245 B	0.195 B	0.540 B	1.44	19.0	18.5	15.8	3.59	0.080	0.236	0.268	0.081 B	16
17	0.242 B	0.200 B	0.570 B	1.62	19.3	17.8	15.7	2.23	0.073 A	0.225	0.283	0.080 B	17
18	0.252 B	0.205 B	0.570 B	1.53	19.0	17.8	15.5	1.49	0.119	0.196	0.260	0.077 B	18
19	0.270 B	0.215 B	0.450 B	1.75	18.7	17.7	15.2	1.10	0.159	0.194	0.249	0.073 B	19
20	0.295 B	0.210 B	0.310 B	2.97	18.8	17.3	15.2	0.858	0.155	0.202	0.262	0.071 B	20
21	0.305 B	0.200 B	0.240 B	4.82	18.5	17.1	15.3	0.697	0.149	0.224	0.240	0.077 B	21
22	0.315 B	0.205 B	0.169 B	7.55	18.3	16.9	15.6	0.589	0.145	0.258	0.256	0.078 B	22
23	0.320 B	0.200 B	0.375 B	9.29	18.2	16.5	15.6	0.457	0.142	0.257	0.274	0.104 B	23
24	0.325 B	0.195 B	0.465 B	10.7	18.2	16.1	15.8	0.348	0.137	0.275	0.272 B	0.120 B	24
25	0.315 B	0.190 B	0.590 B	14.2	18.3	16.2	15.9	0.263	0.119	0.258	0.240 B	0.071 B	25
26	0.300 B	0.200 B	0.800 B	27.2	18.4	15.9	15.7	0.136	0.105	0.291	0.179 B	0.054 B	26
27	0.295 B	0.215 B	0.870 B	24.9	18.3	16.0	15.7	0.108	0.106	0.349	0.157 B	0.044 B	27
28	0.290 B	0.240 B	1.01 B	21.6	18.4	16.3	15.7	0.105	0.109 A	0.319	0.120 B	0.031 B	28
29	0.285 B		1.26 B	20.5	18.8 A	16.0	15.6	0.159	0.104 E	0.333	0.085 B	0.029 B	29
30	0.290 B		1.25 B	20.5	18.6 A	15.7	15.5	0.151	0.100 E	0.351	0.055 B	0.027 B	30
31	0.300 B		1.24 B		18.5		16.1	0.133		0.365		0.025 B	31
TOTAL	8.269	6.816	16.804	195.43	582.7	524.2	482.0	192.974	3.108	7.191	7.392	2.032	
MEAN	0.267	0.243	0.542	6.51	18.8	17.5	15.5	6.22	0.104	0.232	0.246	0.066	MEAN
DAM3	714	589	1450	16900	50300	45300	41600	16700	269	621	639	176	DAM3
MAX	0.325	0.344	1.26	27.2	19.6	19.2	16.1	16.3	0.159	0.365	0.355	0.120	MAX
MIN	0.195	0.190	0.169	1.23	18.2	15.7	15.2	0.105	0.053	0.103	0.055	0.025	MIN

SUMMARY FOR THE YEAR 2001

A - MANUAL GAUGE
B - ICE CONDITIONS
E - ESTIMATED

Total discharge, 175000 DAM3
Mean discharge, 5.56 M3/S
Maximum daily discharge, 27.2 M3/S On 2001-04-26
Minimum daily discharge, 0.025 B M3/S On 2001-12-31
Max Inst discharge, 34.3 M3/S @ 23:30:00 MST On 2001-04-26
Min Inst discharge, 0.017 B M3/S @ 23:59:59 MST On 2001-12-28
REMARKS,

HQ #19.00: 1998-01-01 to open shift corr

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type [1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type [2] (%)						Cover Type [3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Lee Creek																					
	19																				
		14-Aug-00																			
			SHSC	RF	0.14	0.48	0.15	0.005	0	0	0	0	25	70	5	0	30	0	0	0	0
			SHSC	RF	0.09	0.29	0.15	0.005	0	0	0	0	10	80	10	0	60	0	0	0	0
			SHSC	RF	0.05	0.21	0.08	0.005	0	0	5	0	80	15	0	0	10	0	0	0	0
			SHSC	R3	0.15	0.28	0.1	0.005	0	0	0	0	70	20	10	0	20	0	0	0	0
			SHSC	RF	0.12	0.22	0.07	0.005	0	0	0	0	90	10	0	0	10	0	0	0	0
			SHSC	RF	0.1	0.33			0												
			SHSC	RF	0.13	0.49			0												
			SHSC	RF	0.11	0.3			0												
			SHSC	RF	0.05	0.5			0												
	20																				
		13-Aug-00																			
			SHSC	RF	0.06	0.09	0.12	0.005	0	0	5	0	75	15	5	0	30	0	0	0	0
			SHSC	RF	0.07	0.32	0.08	0.005	0	0	5	0	85	10	0	0	25	0	0	0	0
			SHSC	RF	0.04	0.32	0.07	0.005	0	0	10	0	85	5	0	0	10	0	0	0	0
			SHSC	RF	0.08	0.42			0												
			SHSC	RF	0.07	0.27			0												
			SHSC	RF	0.05	0.53			0												
			SHSC	RF	0.04	0.27			0												
Milk River																					
	1																				
		08-Aug-00																			
			SAUG	R3	0.4	0.37		0.005	0	0	20	80	0	0	0	0	0	0	0	100	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type [1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type [2] (%)						Cover Type [3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	1																				
		21-Oct-00																			
			STON	F3	0.33	0.03	54	0.1	0	0	5	5	0	5	85	0	60	0	0	0	0
			STON	F3	0.33	0	54	0.1	0	0	5	5	0	5	85	0	60	0	0	0	0
			STON	F3	0.62	0.06	55	0.1	0	0	5	5	5	15	70	0	40	0	0	0	0
	2																				
		22-Oct-00																			
			SAUG	F2	0.86	0.01	52	0.01	0	0	5	5	0	15	75	0	20	0	0	20	0
			SAUG	F2	0.73	0.04				0	5	75	0	10	10	0	0	0	0	20	0
			SAUG	F2	0.66	0.01				0	5	75	0	10	10	0	0	0	0	20	0
	3																				
		20-Oct-00																			
			STON	RFBG	0.1	0.22	0.24	0.005	0	0	5	5	10	40	40	0	10	0	0	0	0
			STON	F3	0.47	0	0.4	0.01	0	0	10	0	5	20	65	0	20	0	0	0	0
			SHSC	F3	0.18	0.09	0.09	0.01	0	0	10	35	30	20	5	0	5	0	0	0	0
			SHSC	RFBG	0.1	0.25			0												
			SHSC	RFBG	0.17	0.11			0												
			SHSC	RFBG	0.1	0.3			0												
			SHSC	RFBG	0.05	0.05			0												
	4																				
		09-Aug-00																			
			SHSC	RF	0.12	0.6	0.05	0.005	0	0	10	0	90	0	0	0	5	0	0	5	0
			SHSC	RF	0.13	0.77	0.05	0.005	0	0	15	0	85	0	0	0	5	0	0	80	0
			BRMN	RF	0.12	0.6	0.05	0.005	0	0	10	0	90	0	0	0	5	0	0	5	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	4																				
		19-Oct-00																			
			SHSC	R3	0.15	0	0.26	0.01	0	0	5	0	60	20	15	0	20	0	0	0	0
			SHSC	R3	0.15	0.08			0												
			SHSC	R3	0.12	0.1			0												
			SHSC	RF/BG	0.22	0.43	0.25	0.005	0	0	0	0	60	15	25	0	15	0	0	0	0
			SHSC	RF/BG	0.12	0.1			0												
			SHSC	RF/BG	0.2	0.13			0												
			SHSC	RF/BG	0.32	0.24			0												
			SHSC	RF/BG	0.12	0.14	0.36	0.005	0	0	0	0	30	10	60	0	10	0	0	0	0
			SHSC	R3	0.22	0.06	0.06	0.005	0	0	5	75	15	5	0	0	5	0	0	0	0
			SHSC	R3	0.24	0.04	0.05	0.005	0	0	5	75	15	5	0	0	5	0	0	0	0
	5																				
		19-Oct-00																			
			SHSC	RF	0.11	0.16	0.19	0.005	0	0	5	5	55	30	5	0	15	0	0	0	0
			SHSC	RF	0.12	0.27			0												
			SHSC	RF	0.09	0.23			0												
			SHSC	RF	0.08	0.22	0.12	0.005	0	0	0	0	80	15	5	0	10	0	0	0	0
			SHSC	R3	0.14	0.22			0												
			SHSC	R3	0.12	0.3			0												
			SHSC	R3	0.15	0.3			0												
			SHSC	BW	0.1	0	0.11	0.005	0	0	10	0	80	10	0	0	5	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	7																				
		10-Aug-00																			
			SHSC	BW	0.26	0.15	0.15	0.01	0	0	75	0	20	5	0	0	10	0	0	50	0
		19-Oct-00																			
			SHSC	R2	0.78	0.01	0.13	0.005	0	0	10	0	5	60	25	0	20	0	0	40	0
			SHSC	RF	0.06	0.03	0.12	0.005	0	0	5	0	40	55	0	0	40	0	0	0	0
			SHSC	R2	0.57	0	0.32	0.005	0	0	5	0	5	55	35	0	30	0	0	50	0
	8																				
		11-Aug-00																			
			SHSC	RF	0.2	0.81	0.22	0.05	0	0	0	10	75	15	0	0	10	0	0	10	0
			SHSC	RF	0.3	0.21	0.08	0.005	0	0	0	10	85	5	0	0	0	5	0	15	0
			SHSC	BW	0.26	0.33	0.001	0.01	0	0	5	85	10	0	0	5	0	0	0	15	10
			SHSC	RF	0.11	0.32	0.17		0	0	5	0	20	70	5	0	50	0	0	0	0
			SHSC	RF	0.12	0.14	0.17		0	0	5	0	20	70	5	0	50	0	0	0	0
			SHSC	RF	0.27	0.49	0.1		0	0	5	0	20	70	5	0	50	0	0	0	0
			SHSC	RF	0.13	0.52	0.1		0	0	5	0	20	70	5	0	50	0	0	0	0
		19-Oct-00																			
			SHSC	BW	0.16	0	0.15	0.01	0	0	5	5	10	80	0	0	50	0	0	0	0
			SHSC	BW	0.08	0.1	0.13	0.005	0	0	0	0	20	80	0	0	60	0	0	0	0
			SHSC	RF	0.19	0.58	0.17	0.005	0	0	0	0	20	75	5	0	50	0	0	0	0
			SHSC	RF	0.12	0.41			0												
			SHSC	RF	0.12	0.21			0												
			SHSC	RF	0.15	0.83			0												
			SHSC	BW	0.16	0.04	0.14	0.01	0	0	10	0	30	60	0	0	20	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	9																				
		11-Aug-00																			
			SHSC	R3	0.26	0.35	0.15	0.1	0	0	10	55	15	20	0	0	10	0	0	5	0
			SHSC	RF	0.1	0.35	0.25	0.005	0	0	0	5	70	25	0	0	70	0	0	0	0
			SHSC	RF	0.13	0.56	0.25	0.01	0	0	0	5	70	25	0	0	70	0	0	0	0
			SHSC	RF	0.15	0.77	0.25	0.01	0	0	0	5	70	25	0	0	70	0	0	0	0
		18-Oct-00																			
			SHSC	R3	0.14	0.49	0.12	0.005	0	0	5	0	65	30	0	0	20	0	0	0	0
			SHSC	R3	0.26	0	0.13	0.01	0	0	10	0	60	25	5	0	10	0	0	0	0
			SHSC	RF/BG	0.21	0	0.12	0.01	0	0	0	0	5	65	30	0	40	0	0	0	0
			SHSC	R3	0.18	0.21			0												
			SHSC	R3	0.41	0.2			0												
			SHSC	R3	0.22	0.01			0												
			SHSC	R3	0.25	0.06			0												
			SHSC	R3	0.3	0.06			0												
			SHSC	R3	0.25	0.18			0												
			SHSC	BW	0.13	0.05			0												
	10																				
		12-Aug-00																			
			SHSC	RF	0.19	0.72	0.18	0.005	0	0	5	0	60	35	0	0	80	0	0	0	0
			SHSC	RF	0.14	0.32	0.08	0.005	0	0	10	0	85	5	0	0	60	0	0	0	0
			SHSC	RF	0.27	0.61	0.11	0.005	0	0	0	0	90	10	0	0	20	0	0	0	0
		18-Oct-00																			
			SHSC	R3	0.24	0.06	0.17	0.005	0	0	5		10	80	5	0	40	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	10																				
			SHSC	R3	0.15	0.11			0												
			SHSC	R3	0.12	0.05			0												
			SHSC	R3	0.2	0.11			0												
			SHSC	R3	0.19	0.02			0												
			SHSC	R3	0.18	0	0.18	0.005	0	0	5	0	10	80	5	0	30	0	0	0	0
			SHSC	R3	0.25	0.14			0												
			SHSC	R3	0.11	0.6			0												
			SHSC	R3	0.21	0.03			0												
			SHSC	F3	0.42	0	0.18	0.005	0	0	10	0	5	85	0	0	0	0	40	5	0
			SHSC	F3	0.51	0			0												
			SHSC	F3	0.28	0.07			0												
	21																				
		21-Oct-00																			
			SLMN	F3	0.36	0.08	0	0.005	0	0	5	95	0	0	0	0	0	0	0	10	0
			SLMN	R3	0.19	0.39	0	0.005	0	0	5	85	5	5	0	0	0	0	0	5	0
	22																				
		22-Oct-00																			
			BRMN	BW	1.13	0	0.1	0.01	0	0	10	90	0	0	0	0	0	0	0	15	10
			BRMN	BW	0.69	0	0.1	0.01	0	0	10	90	0	0	0	0	0	0	0	15	10
			BRMN	BW	0.83	0	0.1	0.01	0	0	10	90	0	0	0	0	0	0	0	15	10
	23																				
		22-Oct-00																			
			STON	R3	0.44	0.1	0.55	0.005	0	0	5	50	0	10	35	0	20	0	0	0	5

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	23																				
			STON	R3	0.35	0	0.52	0.005	0	0	5	50	0	5	40	0	15	0	0	0	0
			STON	R3	0.28	0.4	0.23	0.005	0	0	0	55	0	5	40	0	20	0	0	0	0
			SAUG	R3	0.49	0.01	0.38	0.005	0.1	0	0	45	0	10	45	0	10	0	0	0	0
			STON	R3	0.33	0.01			0												
			SHSC	R3	0.33	0.35			0												
			STON	R3	0.4	0.24			0												
			STON	R3	0.31	0.3			0												
	24																				
		20-Oct-00																			
			SHSC	RF	0.09	0.06	9	0.005	0	0	5	10	75	10	0	0	5	0	0	0	0
			SHSC	R3	0.16	0.06	8	0.005	0	0	5	10	60	25	0	0	5	0	0	0	0
			SHSC	R3	0.18	0.25	5	0.005	0	0	10	0	80	10	0	0	5	0	0	0	0
	26																				
		20-Oct-00																			
			SHSC	R3/BG	0.2	0	0.23	0.005	0	0	5	5	10	35	45	0	40	0	0	0	0
			SHSC	RF	0.06	0.06	0.14	0.005	0	0	0	0	10	80	10	0	10	0	0	0	0
			STON	RF/BG	0.3	0.19	0.45	0.005	0	0	0	0	10	40	50	0	10	0	0	0	0
			STON	RF/BG	0.31	0.24	0.9	0.005	0	0	0	0	10	15	75	0	30	0	0	0	0
	27																				
		23-Oct-00																			
			SHSC	RF/BG	0.22	0.06	0.17	0.005	0	0	5	5	15	65	10	0	25	0	0	0	0
			SHSC	RF/BG	0.2	0.14	0.24	0.005	0	0	5	5	25	60	5	0	15	0	0	0	0
			STON	RF/BG	0.1	0.06	0.29	0.005	0	0	5	5	10	30	50	0	40	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	27																				
			STON	R3/BG	0.28	0.06	0.35	0.005	0	0	10	0	10	65	15	0	25	0	0	0	0
			STON	R3/BG	0.31	0			0												
			STON	R3/BG	0.2	0			0												
			STON	R3/BG	0.3	0	0.19	0.01	0	0	10	0	10	55	25	0	45	0	0	0	0
			STON	R3/BG	0.26	0.02			0												
	28																				
		20-Oct-00																			
			SHSC	R3	0.31	0.04	0.29	0.005	0	0	5	10	75	5	5	0	30	0	0	0	0
			SHSC	R3	0.12	0.06			0												
			SHSC	R3	0.22	0			0												
			SHSC	R3	0.26	0	0.29	0.005	0	0	10	15	5	65	5	0	15	0	0	0	0
			SHSC	R3	0.29	0			0												
			SHSC	R3	0.29	0.18		0.005	0	0	5	0	45	50	0	0	5	0	0	0	0
			SHSC	R3	0.23	0			0												
			SHSC	P3	0.71	0			0												
	29																				
		23-Oct-00																			
			SHSC	RF/BG	0.15	0.23	0.15	0.005	0	0	0	5	30	50	15	0	5	0	0	0	0
			SHSC	RF/BG	0.25	0.08	0.34	0.005	0	0	5	5	45	40	0	0	40	0	0	0	0
			SHSC	R3/BG	0.2	0	0.35	0.01	0	0	10	20	5	40	25	0	10	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	I990	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
St. Mary River																					
	11																				
		12-Aug-00																			
			SHSC	RF	0.08	0.16	0.22	0.005	0	0	0	0	60	20	20	0	60	0	0	0	0
			SHSC	RF	0.13	0.04	0.33	0.005	0	0	0	0	50	20	30	0	60	0	0	0	0
			SHSC	RF	0.12	0.18	0.36	0.005	0	0	0	0	45	30	25	0	60	0	0	0	0
			SHSC	RF	0.08	0	0.36	0.005	0	0	0	0	50	30	20	0	50	0	0	0	0
			SHSC	RF	0.14	0.1	0.3	0.005	0	0	0	0	65	25	10	0	40	0	0	0	0
	12																				
		12-Aug-00																			
			SHSC	RF	0.14	0.09	0.35	0	0	0	0	0	55	40	5	0	40	0	0	0	0
			SHSC	RF	0.2	0.48	0.35	0	0	0	0	0	55	40	5	0	40	0	0	0	0
			SHSC	RF	0.31	0.58	0.35	0	0	0	0	0	55	40	5	0	40	0	0	0	0
		18-Oct-00																			
			SHSC	R3	0.33	0.46	0.06	0.005	0	0	0	0	95	5	0	0	10	0	0	0	0
			SHSC	RF	0.15	0.63	0.2	0.01	0	0	5	0	40	50	5	0	40	0	0	0	0
			SHSC	RF	0.13	0.43	0.25	0.01	0	0	5	0	30	60	5	0	50	0	0	0	0
			SHSC	RF	0.15	0.45			0												
			SHSC	RF	0.16	0.26			0												
			SHSC	RF	0.14	0.31			0												
			SHSC	RF	0.18	0.38			0												
			SHSC	RF	0.16	0.32			0												
	13																				
		13-Aug-00																			
			SHSC	R3	0.05	0.21	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
St. Mary River																					
	13																				
			SHSC	R3	0.13	0.43	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0
			SHSC	R3	0.28	0.72	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0
			SHSC	R3	0.07	0.13	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0
			SHSC	R3	0.33	1.03	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0
			SHSC	R3	0.27	0.83	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0
			SHSC	R3	0.27	0.89	0.18	0.005	0	0	0	0	20	80	0	0	50	0	0	0	0
			SHSC	RF	0.07	0.3	0.2	0.005	0	0	0	0	15	85	0	0	70	0	0	0	0
			SHSC	RF	0.07	0.34	0.2	0.005	0	0	0	0	15	85	0	0	70	0	0	0	0
			SHSC	RF	0.08	0.66	0.2	0.005	0	0	0	0	15	85	0	0	70	0	0	0	0
			SHSC	RF	0.12	0.41	0.2	0.005	0	0	0	0	15	85	0	0	70	0	0	0	0
			SHSC	RF	0.11	1.2	0.2	0.005	0	0	0	0	15	85	0	0	70	0	0	0	0
	14																				
		13-Aug-00																			
			SHSC	RF	0.2	0.55	0.15	0.005	0	0	0	0	30	70	0	0	40	0	0	0	0
			SHSC	RF	0.19	0.65	0.09	0.005	0	0	0	0	25	75	0	0	20	0	0	0	0
			SHSC	RF	0.2	0.14	0.16	0.005	0	0	0	0	20	75	5	0	40	0	0	0	0
	15																				
		14-Aug-00																			
			SHSC	RF	0.12	0.43	0.23	0.005	0	0	5	0	25	65	5	0	30	0	0	0	0
			SHSC	RF	0.07	0.17	0.17	0.005	0	0	5	0	20	70	5	0	30	0	0	0	0
			SHSC	RF	0.07	0.68	0.08	0	0	0	0	0	85	15	0	0	5	0	0	0	0
		18-Oct-00																			
			SHSC	RF	0.1	0.15	0.16	0.005	0	0	5	0	30	60	5	0	70	0	0	0	0

Appendix E Table 9. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2000.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90	SiltDepth	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
St. Mary River																					
	15																				
			SHSC	RF	0.14	0.31			0												
			SHSC	RF	0.13	0.13			0												
			SHSC	R3	0.26	0.16	0.12	0.02	0	0	10	0	15	75	0	0	40	0	0	0	0
			SHSC	R3	0.34	0.18			0												
			SHSC	R3	0.35	0.14			0												
	16																				
		15-Aug-00																			
			SHSC	RF	0.03	0.22	0.06	0.005	0	0	0	0	95	5	0	0	10	0	0	0	0
			SHSC	RF	0.05	0.29	0.05	0.005	0	0	0	0	100	0	0	0	10	0	0	0	0
			SHSC	RF	0.06	0.39	0.05	0.005	0	0	0	0	100	0	0	0	10	0	0	0	0

[1] See Appendix B for definitions

[2] Substrate type: OM=organic material; SI=silt; SA=sand; GR=gravel; CO=cobble; BO=boulder

[3] Cover type: Veg=submergent vegetation; Rock=rock; OB=undercut or overhanging bank; OV=overhanging vegetation; Turb=depth turbidity; LOD=large woody debris

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Lee Creek																					
	20																				
		23-Oct-01																			
			SHSC	RF	0.2	0.56	0.06	0.002	0		10		70	20			10				
			SHSC	RF	0.11	0.11	0.13	0.001	0		5	15	60	20			10				
			SHSC	RF	0.1	0.41															
			SHSC	R3	0.15	0.07	0.15	0.002	0		5	30	55	10			5				
			SHSC	R3	0.16	0.14															
			SHSC	R3	0.16	0.31	0.13	0.001	0		5	15	50	30			10				
			SHSC	R3	0.21	0.52															
			SHSC	R3	0.1	0.18															
			SHSC	R3	0.15	0.45	0.1	0.001	0		5	5	65	25			10				
			SHSC	R3	0.14	0.46															
Milk River																					
	1																				
		18-Oct-01																			
			SAUG	Ponded	0.27	0	0.44		0		5	90			5		5				
			SAUG	Ponded	0.35	0	0.42		0		5	90			5		5				
			SAUG	Ponded	0.32	0	0.63		0		5	90			5		5				
			SAUG	Ponded	0.44	0	0.65		0		5	90			5		5				
			SAUG	Ponded	0.22	0	0.24		0		5	90			5		5				
			SAUG	Ponded	0.22	0	0.51		0		5	90			5		5				
			SAUG	Ponded	0.28	0	0.38		0		5	90			5		5				

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	1																				
			SAUG	Ponded	0.39	0	0.26		0		5	90			5		5				
			SAUG	Ponded	0.33	0	0.74		0		5	90			5		5				
			SAUG	Ponded	0.42	0	0.39		0		5	90			5		5				
	3																				
		21-Oct-01																			
			SHSC	F3	0.29	0	0	0.01	0			95		5							10
			STON	F3	0.51	0.04	0.29	0.01	0			80			20		5				
			SHSC	F3	0.1	0.2	0.14	0.01	0			10	75	15			10				
			SHSC	F3	0.06	0.39	0.22	0.01	0			5	85	5	5		15				
	4																				
		22-Oct-01																			
			SHSC	R3	0.25	0.04	0.32	0.01	0		10		30	45	15		10				
			SHSC	R3	0.3	0.03	0.31	0.01	0		10		40	40	10		5				
			SHSC	R3	0.21	0.12	0.13	0.01	0		10		65	20	5		5				
			SHSC	R3	0.13	0.22	0.14	0.01	0		10		45	25	20		5				
			SHSC	R3	0.19	0.49															
			SHSC	R3	0.15	0.21	0.3	0.01	0		10		65	10	15		5				
			SHSC	R3	0.17	0.12															
			SHSC	R3	0.15	0.06															
			SHSC	R3	0.18	0.22															
			STON	R3	0.25	0.19	0.35	0.01	0			5	60	10	25		10				

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	4																				
			SHSC	R3	0.27																
			SHSC	R3	0.32																
			SHSC	R3	0.37																
			SHSC	R3	0.41																
			SHSC	R3	0.49																
			SHSC	R3	0.56																
			SHSC	R3	0.32																
			SHSC	R3	0.3																
			SHSC	R3	0.24																
	9																				
		23-Oct-01																			
			SHSC	RF	0.2	0.11	0.17	0.001	0		10	10	15	55	10		20				
			SHSC	RF	0.15	0.12	0.23	0.001	0			5	10	80	5		15				
			SHSC	RF	0.17	0.14	0.21	0.001	0			10	40	30	20		10				
			SHSC	RF	0.15	0.53															
			SHSC	RF	0.21	0.19															
			SHSC	RF	0.09	0.6	0.18	0.001	0				40	55	5		15				
			SHSC	R3	0.21	0.25															
			SHSC	R3	0.31	0.41	0.21	0.001	0				50	40	10		15				
			SHSC	R3	0.18	0.09															
			SHSC	R3	0.18	0.29															

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	21																				
		19-Oct-01																			
			SAUG/SLMN	Ponded	0.2	0	0					100								30	5
			SAUG/SLMN	Ponded	0.33	0	0					100								30	5
			SAUG/SLMN	Ponded	0.36	0	0					100								30	5
			SAUG/SLMN	Ponded	0.4	0	0					100								30	5
			SAUG/SLMN	Ponded	0.46	0	0					100								30	5
			SAUG/SLMN	Ponded	0.53	0	0					100								30	5
			SAUG/SLMN	Ponded	0.59	0	0					100								30	5
			SAUG/SLMN	Ponded	0.55	0	0					100								30	5
			SAUG/SLMN	Ponded	0.62	0	0					100								30	5
			SAUG/SLMN	Ponded	0.68	0	0					100								30	5
			SAUG/SLMN	Ponded	0.61	0	0					100								30	5
			SAUG/SLMN	Ponded	0.54	0	0					100								30	5
			SAUG/SLMN	Ponded	0.64	0	0					100								30	5
			SAUG/SLMN	Ponded	0.46	0	0					100								30	5
			SAUG/SLMN	Ponded	0.39	0	0					100								30	5
	23																				
		21-Oct-01																			
				R3	0.25	0.08						90			10		5				
				R3	0.17	0.29															
				R3	0.28	0.25															

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	23																				
				R3	0.25	0.37															
				R3	0.16	0.22															
				R3	0.37																
				R3	0.41																
	26																				
		21-Oct-01																			
			STON	R3	0.18	0.01	0.65	0.001	0		5	55	10	20	10		10				
			SHSC	R3	0.31	0.01	0.6	0.001	0			45	5	30	20		20				
			SHSC	R3	0.25	0.03	0.28	0.001	0			40		30	30		20				
			SHSC	R3	0.18	0.11	0.35	0.001	0			60	10	20	10		10				
			SHSC	R3	0.2	0.04	0.36	0.001				20	5	35	40		15				
			SHSC	R3	0.22	0.06	0.29	0.001	0			40	10	20	30		10				
			SHSC	RF	0.1	0.27	0.3	0.001	0			10	30	50	10		10				
			SHSC	RF	0.11	0.1															
			SHSC	RF	0.3	0.27															
	27																				
		22-Oct-01																			
			SHSC	R3/BG	0.1	0.17	0.21	0.001	0				10	50	40		60				
			SHSC	R3/BG	0.16	0.01	0.15	0.001	0			5	10	65	20		15				
			SHSC	R3/BG	0.24	0.36															
			SHSC	R3/BG	0.27	0.27	0.23	0.001	0			5	15	60	20		30				

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	27																				
			SHSC	R3/BG	0.27	0.21															
			SHSC	R3	0.25	0.01	0.31	0.001	0		15	10		55	20		20				
			STON	R2	0.62	0.01	0.3	0.001	0		5	20	10	45	20		10				
			SHSC	R3	0.24	0.01	0.3	0.001	0		10	20		40	30		10				
			STON	R2	0.41	0.01	0.49	0.002	0		10	20	5	25	40		30				
			STON	R2	0.65	0.01	0.64	0.002	0		10	20	5	35	30		20				
			STON	R2	0.36	0.01	0.44	0.001	0		5	10		15	70		40				
			SHSC	R3/BG	0.24	0.17															
			SHSC	R3/BG	0.1	0.01															
			SHSC	R3/BG	0.25	0.07															
	28																				
		22-Oct-01																			
			STON	F2	0.66	0.03	0.55	0.001	0			70	5	5	20		15				
			SHSC	RF	0.14	0.21	0.57	0.001	0			10	10	55	25		20				
			SHSC	R3	0.1	0.18	0.15	0.001	0			70	5	20	5		10				
			SHSC	RF	0.14	0.22	0.19	0.001	0			20	10	65	5		20				
			SHSC	R3	0.16	0.13															
			SHSC	RF	0.14	0.21															
			SHSC	RF	0.11	0.2															
			SHSC	RF/BG	0.24	0.01	0.31	0.001	0			10	10	40	40		20				
			SHSC	RF/BG	0.19	0.21	0.15	0.001	0			10	10	50	30		25				

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	28																				
			SHSC	RF/BG	0.1	0.22															
			SHSC	R3																	
			SHSC	R3																	
	30																				
		18-Jul-01																			
				R2			0					100								100	
	36																				
		19-Jul-01																			
			SLMN/SAUG	F3			0	0.1	0		100									100	
		19-Oct-01																			
			SAUG	Ponded	0.25	0	0.67					50	5	15	30		20				
			SAUG	Ponded	0.26	0	0.25					55	5	20	20		10				
			SAUG	Ponded	0.19	0	0.16					80		10	10		10				
			SAUG	Ponded	0.14	0	0.26					80		5	15		10				
			SAUG	Ponded	0.2	0	0.54					65	5	10	20		15				
			SLMN	Ponded	0.33	0	0.15					95		5						5	
			SLMN	Ponded	0.29	0	0.13					95		5		5				5	
	37																				
		20-Jul-01																			
			SLMN	Coulee	1	0	0	0.1			10	90								80	

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	40																				
		18-Oct-01																			
			SAUG	Ponded	0.4	0	0	0.01			25	75								20	10
			SAUG	Ponded	0.45	0	0	0.01			10	90								30	10
	41																				
		18-Oct-01																			
			SAUG	Ponded	0.45	0	0	0	0			100									2
			SAUG	Ponded	0.3	0	0	0	0			100									2
			SAUG	Ponded	0.35	0	0	0	0			100									2
	42																				
		18-Oct-01																			
			SAUG	Ponded	0.61	0			0			95			5		5				
			SAUG	Ponded	0.52	0			0			95			5		5				
			SAUG	Ponded	0.31	0	0.28		0			95			5		5				
			SAUG	Ponded	0.28	0	0.74		0			95			5		5				
			SAUG	Ponded	0.41	0	0.55		0			95			5		5				
			SAUG	Ponded	0.28	0	0.69		0			95			5		5				
			STON	Ponded	0.24	0	1.2		0			95			5		5				
			STON	Ponded	0.29	0	0.47		0			95			5		5				
			SAUG	Ponded	0.33	0	1.9		0			95			5		5				

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	45																				
		19-Oct-01																			
			STON	Ponded	0.3	0	0.52	0.01	0			50	5	15	30		20				
	46																				
		19-Oct-01																			
			SLMN/SAUG	Ponded	0.35	0	0	0.01				100									
	47																				
		19-Oct-01																			
			SAUG/SLMN	Ponded	0.24	0	0	0				100									
			SAUG/SLMN	Ponded	0.35	0	0	0				100									
			SAUG/SLMN	Ponded	0.33	0	0	0				100									
			SAUG/SLMN	Ponded	0.66	0	0	0				100									
			SAUG/SLMN	Ponded	0.64	0	0	0				100									
			SAUG/SLMN	Ponded	0.49	0	0	0				100									
			SAUG/SLMN	Ponded	0.42	0	0	0				100									
			SAUG/SLMN	Ponded	0.17	0	0	0				100									
			SAUG/SLMN	Ponded	0.31	0	0	0				100									
			SAUG/SLMN	Ponded	0.33	0	0	0				100									
			SAUG/SLMN	Ponded	0.39	0	0	0				100									
	48																				
		20-Oct-01																			
			LKCH	F2		0.12	0	0	0			100									5

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
Milk River																					
	48																				
			LKCH	F2	0.2																
			LKCH	F2	0.19																
			LKCH	F2	0.15																
			LKCH	F2	0.23																
	49																				
		20-Oct-01																			
			SLMN	F2	0.6	0	0	0				100								10	
			SLMN	F2	0.62	0	0	0				100								10	
			SLMN	F2	0.72	0	0	0				100								10	
			SLMN	F2	0.65	0	0	0				100								10	
			SLMN	F2	0.74	0	0	0				100								10	
			SLMN	F2	0.7	0	0	0				100								10	
			SLMN	F2	0.81	0	0	0				100								10	
	50																				
		20-Oct-01																			
			SLMN/BRMN	SNYE	0.24	0	0	0.01			5	95								10	
	51																				
		20-Oct-01																			
			SHSC	SNYE	0.3	0	0	0.01			5	95								10	

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
St. Mary River																					
	12																				
		23-Oct-01																			
			SHSC	R3	0.11	0.23	0.001	0.2	0				25	75			20				
			SHSC	R3	0.16	0.32	0.18	0.001	0				30	70			15				
			SHSC	R3	0.1	0.35															
			SHSC	R3	0.17	0.29	0.21	0.001	0				30	65	5		20				
			SHSC	RF	0.24	0.24															
			SHSC	BW	0.09	0.01	0.13	0.001	0				40	60			25				
			SHSC	BW	0.07	0.14															
			SHSC	R3	0.15	0.3															
			SHSC	R3	0.11	0.12	0.14	0.001	0				20	75	5		25				
			SHSC	R3	0.15	0.08															
	15																				
		23-Oct-01																			
			SHSC	R3	0.14	0.11	0.12	0.001	0				10	90			30				
			SHSC	RF	0.1	0.2	0.1	0.001	0				5	90	5		25				
			SHSC	R3	0.15	0.17															
			SHSC	R3	0.11	0.04	0.18	0.001	0				10	85	5		30				
			SHSC	R3	0.17	0.07															
			SHSC	R3	0.21	0.1	0.16	0.001	0				20	80			15				
			SHSC	R3	0.16	0.07															
			SHSC	R3	0.17	0.1															

Appendix E Table 10. Habitat characteristics for the Species of Interest captured in the Milk and St. Mary drainages, 2001.

Waterbody	Site No.	Date	Species	Habitat Type[1]	Depth at Capture (m)	Velocity at Capture (m/s)	D90 (m)	Silt Depth (m)	Distance from Cover (m)	Substrate Type[2] (%)						Cover Type[3] (%)					
										OM	SI	SA	GR	CO	BO	Veg	Rock	OB	OV	Turb	LOD
St. Mary River																					
	15																				
			SHSC	R3	0.5	0.07	0.13	0.001	0				30	70			10				
			SHSC	R3	0.25	0.01															

[1] See Appendix B for definitions

[2] Substrate type: OM=organic material; SI=silt; SA=sand; GR=gravel; CO=cobble; BO=boulder

[3] Cover type: Veg=submergent vegetation; Rock=rock; OB=undercut or overhanging bank; OV=overhanging vegetation; Turb=depth turbidity; LOD=large woody debris

Oneway Analysis of Variance (ANOVA) - St. Mary Sculpin

Capture Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTDEPT	Between Groups	.720	21	3.4E-02	3.730	.000
	Within Groups	1.994	217	9.2E-03		
	Total	2.714	238			

Capture Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTVEL	Between Groups	3.441	21	.164	4.692	.000
	Within Groups	7.298	209	3.5E-02		
	Total	10.740	230			

D90

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
D90	Between Groups	.606	20	3.0E-02	4.092	.000
	Within Groups	.874	118	7.4E-03		
	Total	1.480	138			

Silt Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SILTDEPT	Between Groups	3.3E-03	20	1.7E-04	.412	.987
	Within Groups	4.6E-02	115	4.0E-04		
	Total	5.0E-02	135			

Maximum Water Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERDEP	Between Groups	2.324	18	.129	3.853	.000
	Within Groups	3.852	115	3.3E-02		
	Total	6.176	133			

Maximum Water Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERVEL	Between Groups	10.555	18	.586	12.362	.000
	Within Groups	5.028	106	4.7E-02		
	Total	15.583	124			

Percent Rock as Cover

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
ROCKCOVE	Between Groups	29014.8	19	1527.093	6.115	.000
	Within Groups	29467.1	118	249.721		
	Total	58481.9	137			

Percent Depth/Turbidity as Cover

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
DEPTHCOVER	Between Groups	5289.283	19	278.383	2.769	.001
	Within Groups	7539.665	75	100.529		
	Total	12828.9	94			

Percent Sand as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SAND	Between Groups	18146.6	20	907.330	2.946	.000
	Within Groups	30493.2	99	308.012		
	Total	48639.8	119			

Percent Gravel as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
GRAVEL	Between Groups	50208.3	19	2642.543	5.456	.000
	Within Groups	55695.4	115	484.308		
	Total	105904	134			

Percent Cobble as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
COBBLE	Between Groups	61891.9	19	3257.469	8.431	.000
	Within Groups	45977.5	119	386.366		
	Total	107869	138			

Percent Boulder as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
BOULDER	Between Groups	8087.661	19	425.666	3.854	.000
	Within Groups	11706.8	106	110.441		
	Total	19794.4	125			

Oneway Analysis of Variance (ANOVA) - Stonecat

Capture Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTDEPT	Between Groups	.167	8	2.1E-02	.958	.492
	Within Groups	.478	22	2.2E-02		
	Total	.644	30			

Capture Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTVEL	Between Groups	.147	8	1.8E-02	2.049	.087
	Within Groups	.198	22	9.0E-03		
	Total	.345	30			

D90

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
D90	Between Groups	.531	8	6.6E-02	1.782	.155
	Within Groups	.595	16	3.7E-02		
	Total	1.126	24			

Silt Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SILTDEPT	Between Groups	2.3E-02	7	3.2E-03	204.701	.000
	Within Groups	2.4E-04	15	1.6E-05		
	Total	2.3E-02	22			

Maximum Water Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERDEP	Between Groups	.488	8	6.1E-02	2.200	.076
	Within Groups	.527	19	2.8E-02		
	Total	1.014	27			

Maximum Water Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERVEL	Between Groups	.235	8	2.9E-02	3.327	.015
	Within Groups	.168	19	8.8E-03		
	Total	.403	27			

Percent Rock as Cover

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
ROCKCOVE	Between Groups	4619.000	8	577.375	5.685	.002
	Within Groups	1625.000	16	101.563		
	Total	6244.000	24			

Percent Depth/Turbidity as Cover

ANOVA

		Sum of Squares	df	Mean Square	F
DEPTHCOVER	Between Groups	.000	4	.000	.
	Within Groups	.000	9	.000	
	Total	.000	13		

Percent Sand as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SAND	Between Groups	17514.2	8	2189.280	5.019	.003
	Within Groups	6979.762	16	436.235		
	Total	24494.0	24			

Percent Gravel as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
GRAVEL	Between Groups	3050.000	7	435.714	84.964	.000
	Within Groups	66.667	13	5.128		
	Total	3116.667	20			

Percent Cobble as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
COBBLE	Between Groups	3797.240	7	542.463	3.055	.036
	Within Groups	2485.714	14	177.551		
	Total	6282.955	21			

Percent Boulder as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
BOULDER	Between Groups	8339.155	8	1042.394	2.872	.035
	Within Groups	5806.845	16	362.928		
	Total	14146.0	24			

Oneway Analysis of Variance (ANOVA) - Western Silvery Minnow

Capture Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTDEPT	Between Groups	.495	4	.124	6.274	.001
	Within Groups	.612	31	2.0E-02		
	Total	1.107	35			

Capture Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTVEL	Between Groups	7.7E-03	4	1.9E-03	.411	.799
	Within Groups	.145	31	4.7E-03		
	Total	.152	35			

D90

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
D90	Between Groups	2.0E-02	3	6.7E-03	4.546	.033
	Within Groups	1.3E-02	9	1.5E-03		
	Total	3.3E-02	12			

Silt Depth

ANOVA

		Sum of Squares	df	Mean Square	F
SILTDEPT	Between Groups	8.8E-03	3	2.9E-03	.
	Within Groups	.000	7	.000	
	Total	8.8E-03	10		

Maximum Water Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERDEP	Between Groups	.666	4	.167	14.689	.000
	Within Groups	.363	32	1.1E-02		
	Total	1.029	36			

Maximum Water Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERVEL	Between Groups	1.3E-02	4	3.3E-03	.457	.767
	Within Groups	.231	32	7.2E-03		
	Total	.244	36			

Percent Rock as Cover

Warnings

There are fewer than two groups for dependent variable ROCKCOVE. No statistics are computed.

Percent Depth/Turbidity as Cover

Warnings

There are fewer than two groups for dependent variable DEPTHCOVER. No statistics are computed.

Percent Sand as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SAND	Between Groups	65.972	4	16.493	2.272	.084
	Within Groups	225.000	31	7.258		
	Total	290.972	35			

Percent Gravel as Substrate

Warnings

There are fewer than two groups for dependent variable GRAVEL. No statistics are computed.

Percent Cobble as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
COBBLE	Between Groups	6.250	1	6.250	1.000	.423
	Within Groups	12.500	2	6.250		
	Total	18.750	3			

Percent Boulder as Substrate

Warnings

There are fewer than two groups for dependent variable BOULDER. No statistics are computed.

Oneway Analysis of Variance (ANOVA) - Brassy Minnow

Capture Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTDEPT	Between Groups	.601	2	.300	5.945	.144
	Within Groups	.101	2	5.1E-02		
	Total	.702	4			

Capture Velocity

ANOVA

		Sum of Squares	df	Mean Square	F
CAPTVEL	Between Groups	.288	2	.144	.
	Within Groups	.000	2	.000	
	Total	.288	4		

D90

ANOVA

		Sum of Squares	df	Mean Square	F
D90	Between Groups	8.0E-03	2	4.0E-03	.
	Within Groups	.000	2	.000	
	Total	8.0E-03	4		

Silt Depth

ANOVA

		Sum of Squares	df	Mean Square	F
SILTDEPT	Between Groups	.000	2	.000	.
	Within Groups	.000	2	.000	
	Total	.000	4		

Maximum Water Depth

ANOVA

		Sum of Squares	df	Mean Square	F
WATERDEP	Between Groups	1.051	2	.525	.
	Within Groups	.000	2	.000	
	Total	1.051	4		

Maximum Water Velocity

ANOVA

		Sum of Squares	df	Mean Square	F
WATERVEL	Between Groups	.288	2	.144	.
	Within Groups	.000	2	.000	
	Total	.288	4		

Percent Rock as Cover

ANOVA

		Sum of Squares	df	Mean Square	F
ROCKCOVE	Between Groups	20.000	2	10.000	.
	Within Groups	.000	2	.000	
	Total	20.000	4		

Percent Depth/Turbidity as Cover

ANOVA

		Sum of Squares	df	Mean Square	F
DEPTHCOVER	Between Groups	75.000	1	75.000	.
	Within Groups	.000	2	.000	
	Total	75.000	3		

Percent Sand as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F
SAND	Between Groups	6680.000	2	3340.000	.
	Within Groups	.000	2	.000	
	Total	6680.000	4		

Percent Gravel as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F
GRAVEL	Between Groups	6075.000	1	6075.000	.
	Within Groups	.000	2	.000	
	Total	6075.000	3		

Percent Cobble as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F
COBBLE	Between Groups	.000	1	.000	.
	Within Groups	.000	2	.000	
	Total	.000	3		

Percent Boulder as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F
BOULDER	Between Groups	.000	1	.000	.
	Within Groups	.000	2	.000	
	Total	.000	3		

Oneway Analysis of Variance (ANOVA) - Sauger

Capture Depth

ANOVA

		Sum of Square	df	Mean Square	F	Sig.
CAPTDEPT	Between Groups	.732	8	9.1E-02	6.291	.000
	Within Groups	.683	47	1.5E-02		
	Total	1.415	55			

Capture Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CAPTVEL	Between Groups	1.0E-02	8	1.3E-03	.483	.862
	Within Groups	.125	47	2.7E-03		
	Total	.135	55			

D90

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
D90	Between Groups	3.433	7	.490	7.910	.000
	Within Groups	2.108	34	6.2E-02		
	Total	5.541	41			

Silt Depth

ANOVA

		Sum of Squares	df	Mean Square	F
SILTDEPT	Between Groups	9.3E-03	6	1.6E-03	.
	Within Groups	.000	12	.000	
	Total	9.3E-03	18		

Maximum Water Depth

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERDEP	Between Groups	1.109	8	.139	47.318	.000
	Within Groups	.141	48	2.9E-03		
	Total	1.250	56			

Maximum Water Velocity

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
WATERVEL	Between Groups	2.9E-02	8	3.6E-03	.517	.838
	Within Groups	.338	48	7.0E-03		
	Total	.367	56			

Percent Rock as Cover

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
ROCKCOVE	Between Groups	468.106	6	78.018	5.280	.001
	Within Groups	369.394	25	14.776		
	Total	837.500	31			

Percent Depth/Turbidity as Cover

ANOVA

		Sum of Squares	df	Mean Square	F
DEPTHCOVER	Between Groups	6080.000	2	3040.000	.
	Within Groups	.000	2	.000	
	Total	6080.000	4		

Percent Sand as Substrate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SAND	Between Groups	12309.9	8	1538.741	17.056	.000
	Within Groups	4240.076	47	90.214		
	Total	16550.0	55			

APPENDIX F

Winter Survey Report

FISH SPECIES AT RISK IN THE MILK RIVER, ALBERTA
- LATE WINTER 2002 SURVEY -

R L & L
Environmental Services Ltd.
A member of the Golder Group of companies

Golder Associates

FISH SPECIES AT RISK IN THE MILK RIVER, ALBERTA
- Late Winter 2002 Survey -

Prepared for

Department of Fisheries and Oceans
Freshwater Institute

Prepared by

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March 2002

Cover Photo: Lower Milk River at the Pinhorn Ranch, March 2002.

Suggested Citation: RL&L Environmental Services Ltd. 2002. Fish species at risk in the Milk River, Alberta – Late Winter 2002 Survey. Report prepared for Department of Fisheries and Oceans, Freshwater Institute, Winnipeg. RL&L Report No. 022-7008F: 13 p.

ACKNOWLEDGEMENTS

RL&L Environmental Services Ltd. would like to thank Ray Ratynski of the Department of Fisheries and Oceans for providing funding to conduct this follow-up late winter survey. We would also like to thank Terry Clayton, Richard Quinlan, and Sue Cotterill of Alberta Sustainable Resource Development for involving us in the Species at Risk program for the past two years.

The following staff members of RL&L Environmental Services Ltd. participated in the field program and report preparation:

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1.0 INTRODUCTION

Alberta Sustainable Resource Development (SRD), Fish and Wildlife Division, initiated studies in 2000 to assess the distribution and relative abundance of fish species potentially at risk in the St. Mary and Milk river drainages. These species include St. Mary sculpin (*Cottus* sp.), western silvery minnow (*Hybognathus argyritis*), and stonecat (*Noturus flavus*). Although not listed as a Species at Risk, Alberta SRD was also interested in the status of the brassy minnow (*Hybognathus hankinsoni*) and sauger (*Stizostedion canadense*). In 2000 and 2001, RL&L Environmental Services Ltd. (RL&L) was contracted to document the distribution and abundance of these species. Findings from these two studies indicated that the populations of St. Mary sculpin and stonecat were stable relative to levels documented in previous years, although stonecat abundance remained low. Present data confirmed that the western silvery minnow is rare in the Milk River drainage.

The southern part of the province has been experiencing extreme drought conditions for several years. In October 2001, the lower Milk River did not have flowing water (RL&L 2002). The channel contained only shallow, isolated pools (i.e., in the lower 60 km downstream to the USA border). As a follow-up to recommendations submitted to Alberta SRD (RL&L 2002), RL&L was contracted by the Department of Fisheries and Oceans (DFO) to assess the extent of winter-kill in the lower Milk River and its potential effects on the short and long-term status of the various fish species at risk. The present report outlines the findings of the late winter (March) 2002 follow-up survey.

2.0 METHODS

The winter sampling program was conducted by a two-person crew on 23 and 24 March 2002. In total, ten sites were sampled in the lower Milk River in the vicinity of the Pinhorn Ranch Grazing Lease (Figures 1 and 2). These sites consisted of isolated pools, which were previously sampled during October 2001. Sites where western silvery minnows were documented during fall 2001 were a priority for this sampling session (n=5) followed by sites where other potentially species at risk (i.e., sauger and stonecat) were encountered during the previous fall.

Access to sites in the lower Milk River was by all-terrain vehicle (ATV). At each site, several holes were drilled in the ice to locate the deepest section of the pool. Data collected at each site included: total depth, ice depth, water depth, substrate type, conductivity, water temperature, dissolved oxygen, and presence/absence of fish through the use of an underwater camera. Baited Gee minnow traps were set overnight at sites that had sufficient water depth (e.g. >0.10 m).

Water conductivity was measured with an Oakton TDSTestr3 (±1.0 µS/cm). Dissolved oxygen concentrations (±0.01 mg/L) and temperature (±0.1°C) were measured at each site using an Oxyguard Handy Beta dissolved oxygen-temperature meter.

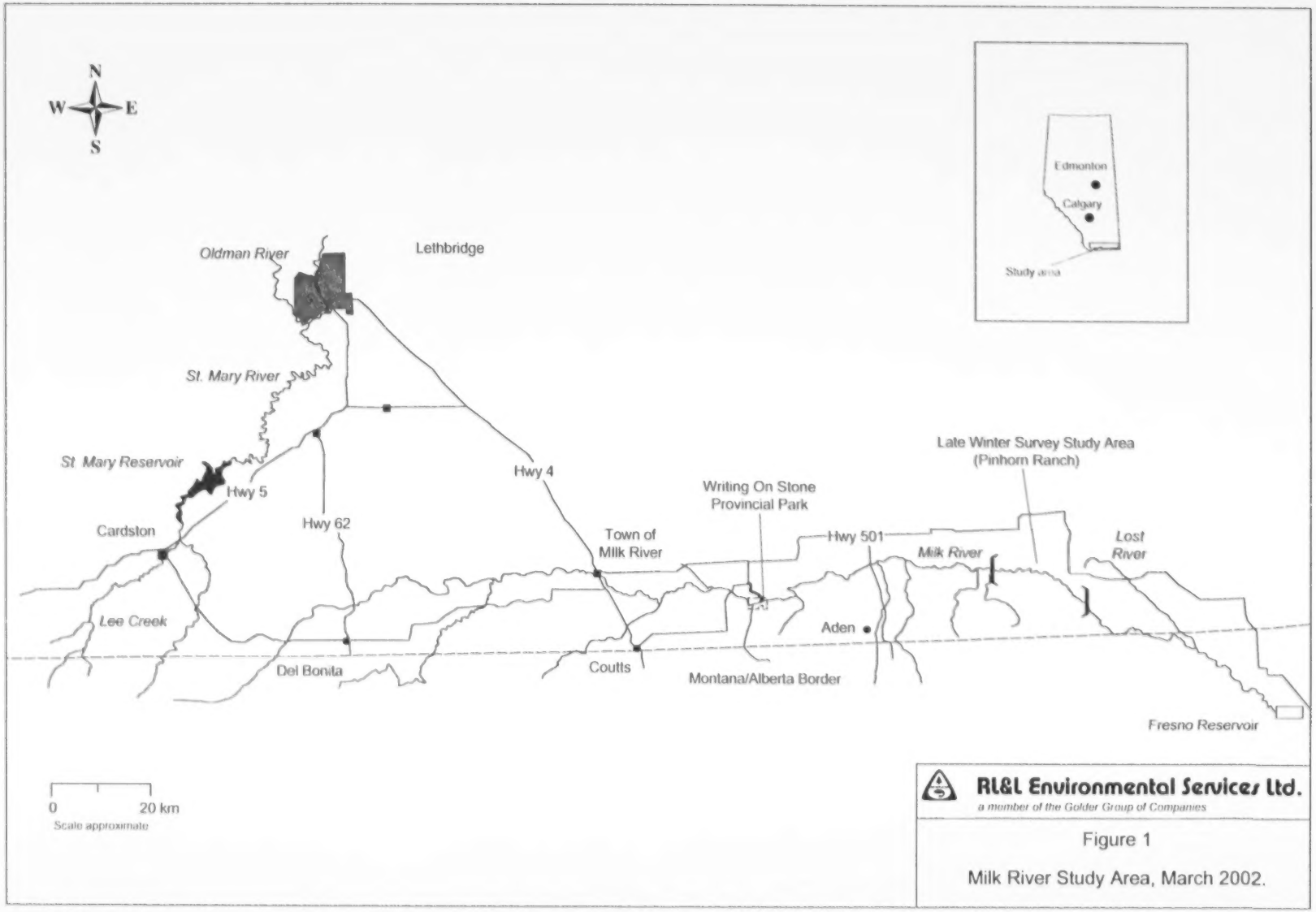

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Figure 1

Milk River Study Area, March 2002.

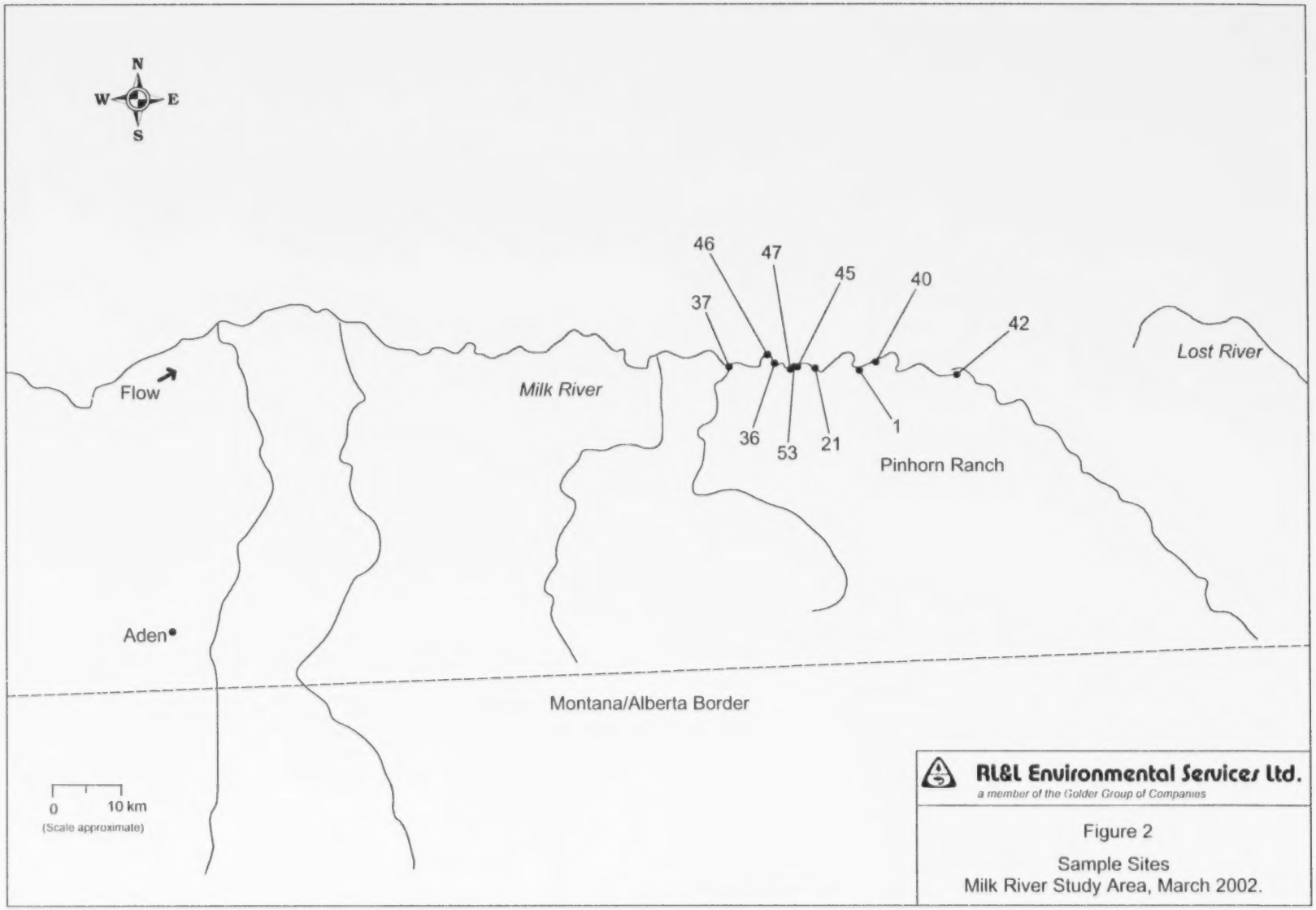
N
W
E
S
46
47
45
40
37
42
Lost River
Flow
Milk River
36
53
21
1
Pinhorn Ranch
Aden
Montana/Alberta Border
0
10 km
(Scale approximate)
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Figure 2
Sample Sites
Milk River Study Area, March 2002.

3.0 RESULTS

3.1 Water Quality and Habitat

Habitat conditions and water depth varied between sites. Total depth (ice and water depth combined) within the isolated pools ranged from 0.41 to 0.91 m, ice depth varied from 0.07 to 0.81 m and water depth ranged from 0 to 0.34 m (Table 1). Ice cover was present at all sites except Site 53 (completely open) and Site 45 (thin ice cover), which were directly influenced by a nearby spring.

The availability of water below the ice varied between sites. Two sites (Sites 1 and 21) were frozen to the river bottom, although some water seepage was apparent. At the remaining sites, water depths under the ice ranged from 0.02 to 0.34 m (mean of 0.15 m).

Water clarity was high (visibility to the bottom) at all sites, which allowed for excellent viewing with the underwater camera. Dissolved oxygen values were high, ranging from 10.2 mg/L at Site 53 to 18.6 mg/L at Site 37. The presence of dissolved oxygen values in the supersaturation range was surprising. Several steps were taken to ensure that the dissolved oxygen meter was functioning properly and that the results were not an artifact of sampling. These included:

- ensuring that the meter was calibrated for the proper elevation,
- all dissolved oxygen readings were taken the day after the power ice auger was used to open up the ice cover,
- Site 45, which had a very thin ice cover, was chiseled in order to avoid possible introduction of oxygen, and
- the meter was tested in tap water.

All of these measures indicated that the meter was functioning properly. As well, a low dissolved oxygen reading was recorded in the outflow from the spring (2.6 mg/L); this low value indicated that the meter was capable of reading low levels.

Conductivity values were also high ranging from 910 to 1750 µS/cm, with a mean of 1080. Water temperatures were generally similar between sites (0°C); however water in the pool at Site 53 (directly influenced by the spring) was warmer (5.3°C). The water temperature directly in the spring was 8.4°C.

Table 1. Habitat data collected at isolated pools in the lower Milk River, March 2002.

Site[a]	Total Depth (m)	Ice Depth (m)	Water Depth (m)	Water Temperature (°C)	Dissolved Oxygen		Conductivity (µs/cm)
					mg/L	% Saturation[b]	
37	0.41	0.27	0.14	0.0	18.6	144	930
46	0.74	0.66	0.08	--	--	--	970
36	0.79	0.68	0.11	0.0	18.4	141	990
47	0.56	0.30	0.24	0.0	18.1	137	910
53 pool	0.25	0.00	0.25	5.3	10.2	88	--
53 spring	--	--	--	8.4	2.6	24	--
45	0.41	0.07	0.34	0.1	17.6	135	980
21	0.64	0.64	0.00	--	--		--
1	0.81	0.81	0.00	--	--		--
40	0.55	0.53	0.02	0.0	17.1	130	1030
42	0.91	0.61	0.30	0.1	17.4	132	1750

[a] See Figure 2 for site locations; sites are listed from upstream to downstream. Site designations correspond to RL&L 2002.

[b] Calculated using Welch 1948.

During October 2001, 32 isolated pools were present in a 6.2 km portion (Sections 1 & 2; Figure 3) of the river near the Pinhorn Ranch (the winter survey study area was inclusive in the 6.2 km portion). Pool lengths during that time ranged from 28 to 354 m (Table 2). The total linear length of the pools was 3.8 km, whereas the total length of river sampled was 6.2 km; thus approximately 2.4 km of the river section sampled was completely dry.

The average wetted width for the two sections during October was 7.1 m (Figure 3). During the summer sampling session (July) wetted widths varied between 40 and 80 m. Average water depth was shallow (0.24 m); maximum water depth recorded in the sections sampled was 0.49 m (Table 2). The average water depth during fall was similar to summer; during summer the average was 0.28 m.

Large differences in total wetted area were documented between July and October. The total wetted area over a 6.2 km section of river was 30 893 m^2 during October, whereas during July the total water surface area was approximately 379 088 m^2 (6.2 km multiplied by an average wetted width of 60.8 m). Using these values, approximately 8% of the water surface area observed during July was available to fish during October. This was further reduced during winter as 4 of the 10 pools (40%) sampled were either frozen to the bottom or had very shallow water depths (<0.09 m). Thus during winter, 60% of the pools had water available to fish, which equated to only 5% of the water surface area that was available during July.

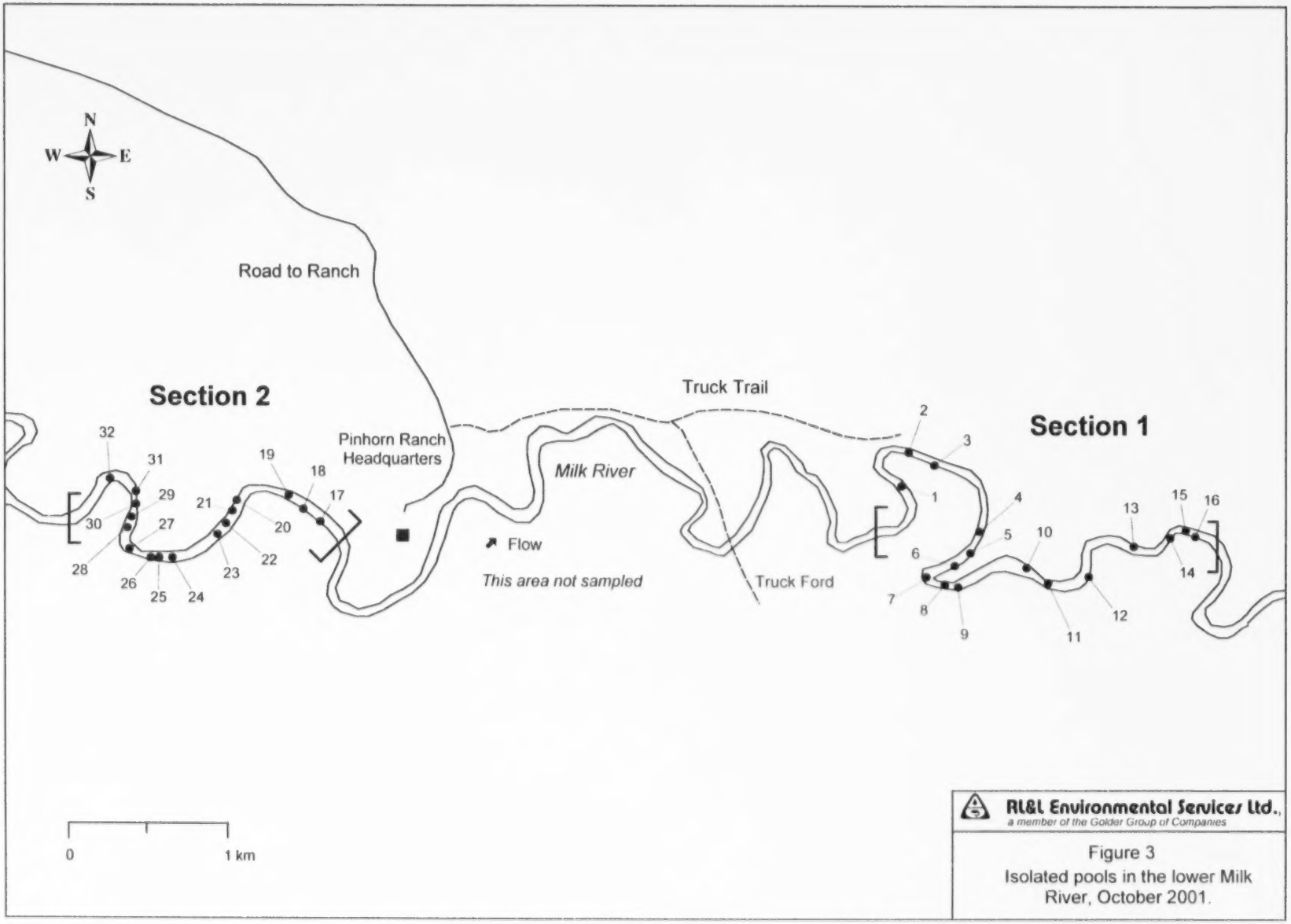

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Figure 3
Isolated pools in the lower Milk River, October 2001.

Table 2. Surface area of isolated pools documented in the lower Milk River near the Pinhorn Ranch, October 2001.

River Section	River Length (m)	No. of Isolated Pools	Mean Length (m)	Mean Width (m)	Mean Water Depth (m)	Mean of Max Depth (m)	Area of Isolated Pools (m^2)			
							Mean	Min	Max	Total Area
Section 1	4144	16	114.7	6.6	0.22	0.50	1125	104	4626	18 005
Section 2	2091	16	88.5	7.8	0.25	0.48	806	112	2304	12 888
Overall	**6235**	**32**	**102.7**	**7.1**	**0.24**	**0.49**	**965**	**104**	**4626**	**30 893**

3.2 Fish

Baited minnow traps were set overnight at several sites; these included Sites 45, 53, 47, 36, and 37. A juvenile longnose sucker (*Catostomus catostomus*) was the only fish captured (Table 3). The underwater camera was used at all sites to search for fish. Fish were recorded only at two sites: six flathead chub (*Platygobio gracilis*) were observed at Site 36 and one flathead chub was observed swimming near the minnow trap at Site 47.

Western silvery minnow were not captured or observed; however of the five isolated pools holding western silvery minnow during fall 2001, two supported flathead chub during March (Table 4). These two sites (Sites 47 and 36) accounted for 14 of the 31 western silvery minnows encountered during fall 2001 at sites in the vicinity of the Pinhorn Ranch Grazing Lease.

Table 3. Fish species observed or captured in the lower Milk River, March 2002.

Site	Flathead chub	Longnose sucker	Total
53	0	1[b]	1
47	1[a]	0	1
36	6[a]	0	6
Total	**7**	**1**	**8**

[a] Observed using underwater camera.
[b] Captured in minnow trap.

Table 4. Fish species and number of fish encountered in the lower Milk River during October 2001 (these sites were re-sampled in March 2002).

Species	Site[a]								
	37[b]	46	36[c]	47[c]	45	21	1	40	42
Western silvery minnow	1	1	2	12		13			
Sauger		1	6	4	1	10	11	5	9
Stonecat					1				4
Burbot							1		1
Flathead chub	21	151	196	1250	93	1263	85	1	131
Longnose dace		20	8		8		21	3	
Longnose sucker			6		9	51	14	3	6
Sucker spp.	13			40	4				
White sucker		2			5	13		2	

[a] See Figure 2 for site locations; sites are listed from upstream to downstream. Site designations correspond to RL&L 2002.
[b] Sampled in July 2002, not October.
[c] Flathead chub observed at these sites in March 2002.

4.0 DISCUSSION

Water depths and dissolved oxygen recorded in the isolated pools during October 2001 and March 2002 are compared in Table 5. Generally, isolated pools located near springs had higher water depths during winter (i.e., Sites 45, 53, 47). Pools further downstream were frozen to the bottom with the exception of Site 42. This site was located at the mouth of a coulee which could have had some groundwater upwellings; the presence of a high conductivity value (1750 µS/cm) at Site 42 also suggests that there may be a groundwater source nearby. High conductivity values are usually an indication of high dissolved mineral content in water. These values are not detrimental to fish.

Two of the ten sites (Sites 21 and 1) were frozen to the bottom, while two other sites (Sites 40 and 46) contained very little water (<0.09 m water depth). Of these sites, both western silvery minnow and sauger were captured in October at Sites 21 and 46. Sauger were also captured at Sites 1 and 40 during fall 2001. Based on the water depth, survival of these fish is unlikely.

Of the sites where fish were observed during the winter survey (Sites 47 and 36), water depths were 0.11 and 0.24 m. Evidently these depths allowed survival of flathead chub which were observed swimming under the ice. All fish appeared to be healthy (i.e., emaciation was not apparent) and some were observed eating organisms floating in the water column.

Dissolved oxygen values recorded during both sampling periods were high, although the values recorded in March were higher than expected. Values in October ranged from 10.5 to 13.5 mg/L, while in March values ranged between 10.2 and 18.6 mg/L. The values recorded in March likely reflect increased photosynthetic activity by algae. Since snow cover was low for most of the year, there could be sufficient light penetration for algal photosynthesis to occur. Similar results were documented in an under-ice study on the Athabasca River; the authors of this study attributed the supersaturation of dissolved oxygen to photosynthesis of attached benthic algae (Noton et al. 1996). Also, very little organic matter was observed during fall sampling therefore oxygen depletion due to decomposition would be relatively low. Of the pools that had water present, the dissolved oxygen values observed within the isolated pools during late winter provide adequate amounts for fish survival. The Alberta water quality guidelines for aquatic biota state that the acute limit of dissolved oxygen is 5.0 mg/L and the chronic limit is 6.5 mg/L (Alberta Environment 1999).

Table 5. Summary of water depths and dissolved oxygen levels in the lower Milk River, October 2001 and March 2002.

Site [a]		Water Depth (m)			Dissolved Oxygen (mg/L)		
		October 2001 [b]	March 2002	Difference between March and October	October 2001	March 2002	Difference between March and October
Downstream	42	0.36	0.30	-0.06	--	17.4	
	40	0.54	0.02	-0.52	10.5	17.1	+6.6
	1	0.32	0.00	-0.32	11.2	--	
	21	0.49	0.00	-0.49	11.0	--	
	45	0.30	0.34	+0.04	13.5	17.6	+4.1
	53	--	0.25		--	10.2	
	47	0.43	0.24	-0.19	12.9	18.1	+5.2
	36	0.22	0.11	-0.11	11.2	18.4	+7.2
	46	0.58	0.08	-0.5	10.8	--	
Upstream	37	--	0.14		--	18.6	
Mean		**0.41**	**0.15**		**11.59**	**16.8**	

[a] See Figure 2 for site locations.
[b] Values in October 2001 are mean values for each site.

5.0 SUMMARY

Based on the results of the present study, it appears that water depth is the main factor limiting fish survival in the isolated pools of the lower Milk River. Isolated pools located near a spring generally had higher water depths than pools which were not within the influence of a spring. Pools not within the zone of influence from a spring were frozen to the bottom.

Only a small portion of the wetted channel that was available during summer was available to fish during fall and winter. Approximately 8% of the water surface area present during July was available to fish during October. This was further reduced over the winter as only 60% of the pools had water available to fish. As such, only 5% of the water that was available to fish during July was available during late winter.

Although some pools were suitable for fish to overwinter, most pools were not suitable. For this reason, it is likely that most fish species (particularly those that are not well-represented) will be negatively impacted by the extreme drought conditions experienced in the lower Milk River within the past year. This is particularly true for species such as the western silvery minnow, which is relatively rare in the Alberta portion of the Milk River.

The success of the various fish Species at Risk at re-establishing their former range and abundance in the lower Milk River cannot be predicted at this time. However, it seems certain that the populations will require considerable time to recover and this assumes that the isolated pools documented in the present study were suitable refugia for key species such as western silvery minnow, stonecat, sauger, and brassy minnow.

6.0 LITERATURE CITED

Alberta Environment. 1999. Surface water quality guidelines for use in Alberta. Environmental Services. Edmonton. Alberta.

Noton, L.R. and K.A. Saffran. 1996. Water quality in the Athabasca River system, 1990-1993. Report prepared for Alberta Environmental Protection, Surface Water Assessment Branch, Technical Services and Monitoring Division. 239 p.

RL&L Environmental Services. 2002. Fish species at risk in the Milk and St. Mary drainages. Report prepared for Alberta Sustainable Resource Development. Fish and Wildlife Division - Prairie Region. RL&L Report No. 012-7001D: 80p. + 5 Appendices.

Welch, P.S. 1948. Limnological Methods. McGraw-Hill Book Company. New York. 381 p.

PLATES

Plate 1 **Milk River**, *23 March 2002*. Looking downstream towards Site 40 on right downstream bank.

Plate 2 **Milk River**, *24 March 2002*. Looking upstream from Site 36.

Plate 3 **Milk River,** *24 March 2002*. Looking for fish at Site 36 using an underwater camera.

Plate 4 **Milk River,** *23 March 2002*. Baited minnow trap set at Site 47.

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